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BLIJDORP (P. A.). **Voorloopige mededeeling over de resultaten der proefnemingen met chemische middelen ter bestrijding der karwijmot (*Depressaria nervosa* Hw.) in 1934.** [Preliminary Communication on the Results of Experiments in 1934 with Chemicals against the Caraway Moth, *D. nervosa*.]—*Versl. PlZiekt. Dienst* no. 78, 18 pp., 3 pls. Wageningen, January 1935. [Recd. June 1935.]

SPOON (W.). **Bestrijding van de karwijmot door stuiven met Derris-poeder.** [Control of the Caraway Moth by Dusting with Derris.]—*Ber. HandMus. kolon. Inst. Amst.* no. 94, 8 pp., 2 figs., 4 refs. Amsterdam, 1935. (Repr. from *De Indische Mercuur* 27th March 1935.)

The first paper deals in detail and the second more briefly with experiments carried out in 1934 by Blijdorp against *Depressaria nervosa*, Haw., on caraway (*Carum carvi*) in Holland. The insecticides tested included mineral oils and dusts of arsenicals, sodium and barium fluosilicates and derris. The derris proved superior to the fluosilicates which, as in previous tests [*R.A.E.*, A **22** 270], were more effective than the other insecticides. The derris powder used was one that yielded 8 per cent. rotenone and 21 per cent. ether extract and was mixed with 3 parts of French chalk. The smallest quantity of the mixture (33 lb. per acre) gave better results than the largest quantity (133 lb. per acre) of either 20 per cent. barium fluosilicate or 30 per cent. sodium fluosilicate. With double the amount of the derris dust mixture practically complete control was obtained.

FEYTAUD (J.). **La question doryphorique au début de la campagne 1935.**—*Rev. Zool. agric.* **34** nos. 4–5 pp. 49–68, 69–82, 1 map. Bordeaux, April–May 1935.

The situation regarding *Leptinotarsa decemlineata*, Say, on potato in France at the beginning of the 1935 campaign is reviewed [*cf. R.A.E.*, A **22** 434], details being given of its distribution in the previously infested Departments (of which Eure is now free from infestation) and in the 20 new Departments to which the infestation has only recently spread. The number of the infested Departments has thus increased to 59. Except towards the north, the beetle has spread in all directions, especially towards the plateau of Langes and the Mediterranean. As a result of the comparative earliness of spring in 1934 breeding began sooner than usual, and subsequent hot weather and occasional winds increased the number of the beetles emerging and assisted their dissemination. The foliage and fruit of the egg plant (*Solanum melongena*) were more heavily attacked than ever before, especially in the Departments of Aude and Gard.

The control measures were the same as applied previously [*cf.* **21** 6]. The number of syndicates for plant protection in view of the harm done by this insect has considerably increased. Further experiments in the use of *Petunia* [**22** 434, 665, etc.] have definitely shown that it is of no value as a trap-plant. The breeding of the predacious Pentatomids, *Perillus bioculatus*, F., and *Podisus maculiventris*, Say, has been continued.

Zones contaminées par le doryphore.—*Rev. Zool. agric.* **34** nos. 5–6 pp. 82–84, 93–99. Bordeaux, May–June 1935.

This report of the survey of the zones in France that are infested by *Leptinotarsa decemlineata*, Say, has been arranged on the same lines as

the report on the protective zones [*R.A.E.*, A **22** 511]. A list is now given of the cantons that lie wholly or in part within the infested zones.

COUTURIER (A.). **Remarques sur *Anaphes pratensis* Förster ennemi des pontes du Doryphore.**—*Rev. Zool. agric.* **34** no. 6 pp. 88–92, 10 refs. Bordeaux, June 1935.

In May 1932 the author found in a potato field in the Department of Gironde 12 dead females of the Mymarid, *Anaphes pratensis*, Frst., stuck to the viscous surface of the eggs of *Leptinotarsa decemlineata*, Say. In May of the following year a female that had been observed puncturing the eggs of the beetle in the field was taken into the laboratory where it lived for two days, during which 44 eggs of *L. decemlineata* were offered to it. The Mymarid was seen to insert its ovipositor into some, but it is not known whether it laid any eggs in them. However, only 45 per cent. of the eggs offered to the parasite gave rise to normal larvae as compared with 90 in the control. The others either did not hatch at all (usually owing to an abnormal development of the embryo), or produced larvae that failed to live. Two of the eggs that produced normal larvae had been punctured by the parasite. This fact, however, may be explained by the possible absence in the parasite of the active ovicidal principle. It is only with some difficulty that the parasite can detach its legs from the sticky surface of the beetle's eggs. Though *A. pratensis* has previously been recorded from France, its host there is unknown. It is pointed out that this Mymarid parasitises the eggs of *Hypera punctata*, F., in Utah [*R.A.E.*, A **19** 70].

HINMAN (F. G.) & LARSON (A. O.). **Insects collected in Flight Traps in the Willamette Valley, Oregon, in 1931 and 1932.**—*Ent. News* **46** no. 6 pp. 147–153, 3 refs. Philadelphia, Pa, June 1935.

With a view to obtaining data on insects occurring in the Willamette Valley, Oregon, a study on the lines of that carried out by Rice in Idaho [*R.A.E.*, A **22** 94] was conducted by the authors in 1931 and 1932, with the flight traps similar to those employed by Wakeland [**22** 418]. A list of 14 orders obtained is given, showing the numbers of families, species and specimens. There is also a list of the species caught in numbers above 100. The pea Aphid, *Macrosiphum onobrychis*, Boy. (*Illinoia pisi*, Kalt.), was the most abundant species. In 1932 only half as many insects were trapped as in 1931. This difference is attributed to the fact that the winter of 1930–31 was very mild, whereas the unusually severe winter of 1931–32 resulted in smaller numbers of almost every species and the almost total absence of *Macrosiphum* and its predators.

Department of Entomology.—*Rep. Purdue Univ. agric. Exp. Sta.* **47** (1933–34) pp. 33–37, 2 figs. Lafayette, Ind. [1935.]

Work against insect pests in Indiana during the year ending 30th June 1934 is briefly reviewed. The onion thrips [*Thrips tabaci*, Lind.] caused considerable damage to onion, and also to carrot seedlings, cabbage, celery, cucumbers and melons wherever any of these crops were cultivated near onion fields. Planted onion sets were particularly attractive and were frequently responsible for a heavy infestation on

seed planted onions. Spraying with 40 per cent. nicotine sulphate, penetrol or a similar spreader, and water (1 : 2 : 800) gave good control. The striped cucumber beetle [*Diabrotica melanocephala*, F.], which continued to cause much damage to melons and cucumbers, was best controlled by a dust of 1 part barium fluosilicate, with 3 parts flour, talc or colloidal clay. Plants that were dry and had outgrown the seedling stage were not injured. In spraying experiments to control the leafhopper [*Empoasca fabae*, Harr.] on potato, a Bordeaux spray (4–6–50) was again the most effective [*cf. R.A.E.*, A **21** 452]. Continued investigations on the control of the mint flea-beetle [*Longitarsus waterhousei*, Kutsch.] showed that it may be successfully controlled at a minimum cost by dusting the growing plants with calcium arsenate mixed with colloidal clay, and by treating the stubble with Paris green and flour (1 : 9) [*cf.* **19** 205]. In spite of the abnormal conditions which have been unfavourable to the European corn borer [*Pyrausta nubilalis*, Hb.] during the past few years, it has increased, and serious infestation of maize have been observed in individual fields. Three, two and one applications of a calcium fluosilicate spray reduced the borer population by 91, 82 and 62 per cent., respectively. The corresponding percentages for a similar dusting programme with this insecticide were 75, 63 and 60. A severe outbreak of the chinch bug [*Blissus leucopterus*, Say] on cereals occurred in 1934 [*cf.* **22** 256]. Large acreages of maize were, however, safeguarded from the migrating bugs by the use of creosote barriers. Lead arsenate continued to be the most effective insecticide in the control of the codling moth [*Cydia pomonella*, L.] on apple, especially when oil is used with it [**22** 28]. Other useful control measures [*cf.* **22** 693] included screening packing sheds, using chemically treated bands to destroy the larvae, and employing surface burners to kill larvae hibernating in débris on the surface of the soil. *Macrocentrus ancylivorus*, Rohw., liberated against the oriental fruit moth [*Cydia molesta*, Busck], has increased in some localities and exercised an important check on the pest. Excellent control of cutworms in golf greens was obtained by applying a mixture of 4 lb. lead arsenate and 1 bushel dry sand, and washing it well into the turf.

Ball (E. D.), Reeves (J. A.), Boyden (B. L.) & Stone (W. E.). **Biological and Ecological Factors in the Control of the Celery Leaf Tier in Flordia.**—*Tech. Bull. U.S. Dep. Agric.* no. 463, 55 pp., 26 figs., 13 refs. Washington D.C., February 1935.

This is a general preliminary account of investigations extending over 3 years on *Phlyctaenia rubigalis*, Gn., in Florida. It is prefaced by an ecological discussion and includes comprehensive studies of temperature in relation to the moth and to celery (this part being illustrated by numerous graphs), together with investigations on the natural biological control of the moth and on its economic importance.

A mean temperature of 58–59°F. reduced the rate of development to a point where the life-cycle cannot be completed on the celery crop under normal conditions, but at 63°F. development is rapid enough to provide for moths to mature on one crop and migrate to the next so that infestation is continuous. The rapidity of development increases up to and perhaps beyond 75°F. It is probable, but not certain, that the leaf tier aestivates in the adult stage. The first adults do not appear in the field until the temperature falls to 77°F. At this temperature, the

life-cycle takes a little over a month. In cold winters, with a temperature of about 55°F., the life-cycle requires above 3 months. In Florida during the season 1925–26, when the winter temperatures were about 1°F. below normal, there were only three generations, but in 1926–27, when the winter temperatures were about 3°F. above normal, there were four. In 1927–28, when the temperatures in winter were slightly below the average, but when the spring was abnormally warm, there were four generations and a partial fifth between September and June.

The following is based on the authors' summary. In view of the sudden and unprecedented increase of *Phlyctaenia* in the Sandford district, Florida, during 1923 and 1925, the three main factors involved in the natural balance are dealt with in order of their importance. In the first place, a fluctuation of 1 or 2 degrees from the normal mean temperature during December–February made all the difference between serious infestation and no commercial injury. In the second place, *Trichogramma minutum*, Riley, multiplied in the rising spring temperatures and destroyed many of the eggs of *Phlyctaenia*. After these had disappeared it parasitised the eggs of the Pyralids, *Loxostege similalis*, Gn., *Hymenia perspectalis*, Hb., *H. fascialis*, Cram., and *Psara* (*Pachyzancla*) *bipunctalis*, F., on *Amaranthus* spp., and after increasing greatly during late summer, it destroyed most of the eggs of the first brood of *Phlyctaenia* that would hatch in autumn. Finally, migratory birds overwintering in the region or passing northwards eradicated the larvae and pupae of *Phlyctaenia* and *Syngrapha* (*Autographa*) *falcifera*, Kby. (celery looper) from isolated fields and others near woods. In thickly planted areas without shelter, birds were not numerous enough to check the larvae. Swallows circled round the machines distributing pyrethrum dust and caught 80–90 per cent. of the moths as they flew up to avoid the fumes. Other natural enemies of minor importance include the larval parasites, *Casinaria infesta*, Cress., and *Apanteles marginiventris*, Cress., a bacterial and a fungus disease and a spider.

In normal seasons the factors constituting the natural balance could keep the numbers of *Phlyctaenia* low, but after two consecutive warm winters the pest increased enough to be harmful and after three it caused extremely severe damage. A study of the winter temperatures indicated that such climatic factors occur very rarely. The proper use of pyrethrum dusts, with applications timed to take advantage of the activities of swallows, controlled even the worst outbreaks.

DUNHAM (R. S.). **Stem Maggot Injury among Wheat Varieties.**—*J. Amer. Soc. Agron.* **26** no. 11 pp. 978–980, 4 refs. Geneva, N.Y., November 1934. [Recd. July 1935.]

Meromyza americana, Fitch, has become increasingly injurious to wheat in north-western Minnesota during the last 5 years. Tables show data on the average percentage of dead spikes on nine varieties of wheat during 1929–33, based on samples of 100 culms from each of three plots planted on the same day in uniform soil. Dates of the heading of the varieties are also presented to help in the study of associations between maximum injury and early or late maturity. Mathematical calculations show that if the percentages of dead spikes on various varieties

differ by 2·22 there is a 19 to 1 chance that these varieties will show a significant difference in the extent to which they are susceptible to injury by the larvae.

VEITCH (R.). **The Brown Vegetable Weevil.**—*Qd agric. J.* **43** pt. 5 pp. 442–444, 1 pl. Brisbane, 1st May 1935.

The brown vegetable weevil [*Listroderes costirostris*, Schönh.] has recently become established in Queensland, where its distribution increases each year. It is most injurious during the winter and spring and to potato and tomato, but also attacks a variety of other vegetables, tobacco seedlings, etc. Notes on its bionomics and control are given [*cf. R.A.E.*, A **22** 658, etc.]. Wild food-plants should be dusted or sprayed with lead arsenate.

MOZNETTE (G. F.). **Experiments in Control of the Pecan Black Aphid under Orchard Conditions.**—*Proc. Southeast. Pecan Growers Ass.* **28** (1934) pp. 55–58, 60, 61. (Abstr. in *Exp. Sta. Rec.* **72** no. 6 p. 812. Washington, D.C., June 1935.)

Work carried out during 1932–33 showed that *Melanocallis caryaefoliae*, Davis, may be effectively controlled and premature defoliation of pecan prevented by the addition of nicotine sulphate (1 : 4,000) to the summer applications of Bordeaux mixture and, where necessary, by its further use with summer oil emulsion ($\frac{1}{2}$: 100) in the autumn. Spraying should be done when the Aphids are first noticed in small numbers and before any yellowing of the foliage has occurred. Where this pest was controlled throughout 1932 and no premature defoliation took place, the trees gave a far better crop of nuts in spring than unsprayed trees, which were severely damaged.

MAKARJAN (M. A.). **Contributions to the Knowledge of Orthopterous Fauna of Abaran (Armenia).** [*In Armenian.*]—*Bull. Inst. Sci. R.S.S. Arménie* **1** pp. 77–86. Erivan, 1931. (With a Translation in Russian and Summaries in English and Russian.) [Recd. May 1935.]

A description of the physical conditions, climate and vegetation of the region of Abaran in Armenia, which is of interest owing to the frequent outbreaks of *Calliptamus italicus*, L., and a list of Orthoptera found there are given.

MENOZZI (C.). **Ricerche su due parassiti della mosca della barbabietola (*Pegomyia hyoscyami*, Panz.) in Italia.** [Investigations on two Parasites of the Beet-fly, *P. hyoscyami*, in Italy.]—*Industr. saccar. ital.* **28** no. 3, reprint 5 pp. Genoa, March 1935. [Recd. June 1935.]

In Italy *Trichogramma evanescens*, Westw., and *Opius ruficeps*, Wesm., are the chief parasites of the beet-fly, *Pegomyia hyoscyami*, Panz. [*cf. R.A.E.*, A **19** 462], although they are at present of secondary importance. In Central Italy during 1931–34 *T. evanescens*, which has a wide range of hosts, parasitised from 42 to 78 per cent. of the eggs of the overwintered generation of *Pegomyia*, but in Northern Italy few of the eggs are attacked. In Northern Italy the action of the parasite is dispersed because *Pegomyia* oviposits at the same time or little before *Cassida nobilis*, L., which is also a pest of beet and

a host of the Trichogrammatid. In Central Italy the eggs of *C. vitatta*, Vill. are laid a good deal earlier than those of *Pegomyia* and hatch some time before the Trichogrammatid appears. The effect of the parasite on subsequent generations of the fly is negligible because by this time its activity is very widely dispersed and its brief life-cycle fails to synchronise with that of its host. *O. ruficeps* parasitises the larvae of all generations of *Pegomyia*. It has three generations a year, or at least there are three generations involving *Pegomyia*. Its life-cycle, 22–29 days, is about 8 days shorter than that of its host. In Northern Italy it hibernates in the puparium of its host and the adult emerges at the end of April. In Central Italy it has sometimes been observed to overwinter as an adult. During 1930–34 the percentages of parasitism in the larvae of the first, second and third generations of the fly were 6–47, 3–12 and 8–16, respectively. Although *O. ruficeps* also parasitises the larvae of various Lepidoptera and Diptera, the decrease in parasitism of *Pegomyia* after the first generation is rather to be attributed to the difference in the preoviposition periods of the host and its parasite, which cover 10–12 and 4–6 days, respectively.

Jannone Lodispoto (G.). **Un nuovo sistema per proteggere gli alberi dalle formiche : doccia anulare di gomma modello " Baraffa."** [A new Method for protecting Trees against Ants : the " Baraffa" annular Rubber Water Trough.]—*Ortofruttic. ital.* 1934, reprint 4 pp., 3 figs. Rome, April 1934. [Recd. June 1935.]

To prevent ants from ascending fruit trees Baraffa has designed an annular rubber water trough to encircle the trunk at any suitable height from the ground. It is a cheap and simple device. An inner tube of an old motor tyre is cut into trapezoidal bands, which are fitted tightly to the trunk along the shorter curved side, which must be uppermost. After the overlapping section has been cemented, the rubber is bent upwards to form a trough. The inside edges of the trough are reinforced with strips of rubber, which help to hold in position curved pieces of zinc wire (not less than $\frac{1}{10}$ in. in diameter) fitted inside to the contour of the trough to stop it from collapsing. The trough is filled with water, which may be covered with a film of oil to prevent mosquitos from breeding. Against ants or Lepidopterous pests an insecticide or repellent solution may take the place of water. The troughs can be used again and again.

[Rikhter, A. A.] **Рихтер (A. A.). On the Ecology of** *Chrysobothris chrysostigma*, **L. Coleoptera Buprestidae.** [*In Russian.*]—*Bull. Acad. Sci. U.R.S.S.* **1934** no. 9 pp. 1411–1422, 1 map, 2 pls., 2 figs., 35 refs. Leningrad, 1934. (With a Summary in English.) [Recd. June 1935.]

Chrysobothris chrysostigma, L., a new pest of spruce (*Picea excelsa*), was observed around Leningrad in 1932–33. The larvae live under the bark of the trunks in full sunlight. They penetrated into the sapwood as far as 20 mm. from the surface of the wood for the diapause in summer and again in autumn for hibernation and pupation. Adults are on the wing from May to August. The complete life-cycle takes 1 or 2 years. The distribution of this Buprestid is co-terminous

with coniferous forests. The author suggests that some references in the German literature to its occurrence in deciduous forests may be due to misidentification of *C. affinis*, F.

Gros (R.). **Premières remarques sur l'étude expérimentale de l'effet toxique présenté par divers sels arsenicaux sur le doryphore de la pomme de terre.**—*Rev. Path. vég.* **21** no. 1 pp. 75–82, 2 refs. Paris, 1934. [Recd. July 1935.]

In experiments in France on the toxic effect of arsenical salts on the larvae of *Leptinotarsa decemlineata*, Say, a number of third instar larvae were fed on potato leaves treated with an equal dose of arsenic in the form of different salts. The amount of As_2O_3 or As_2O_5 on the leaves varied from 0·015 to 0·043 mg. per cm^2. Larvae taken daily from infested fields were reared in cages on clean leaves. Those that had not fed at the end of 12 hours were eliminated, and the others were starved for 12 hours before being fed on poisoned leaves. Within 30 minutes all had begun to feed. The tests with each arsenical were repeated, 8 larvae being used in the first experiment and 4 in the second. There was a considerable difference between the amounts of leaf eaten at different temperatures, but the differences remained relatively constant among the various salts. When the more adherent products, *viz.*, lead arsenates, copper arsenite and copper aceto-arsenite (Paris green), were used the amount of leaf eaten in the two experiments was about the same and the quantity of arsenic consumed was approximately equal to the lethal dose. At a temperature of 15°C. the quantities (in mm^2) of leaf consumed and the percentages of larvae dead after 20 hours in tests with leaves treated with the various arsenical salts were as follows:—triplumbic lead arsenate, 100 and 10, diplumbic lead arsenate, 25–30 and 70, magnesium arsenate, 16 and 70, calcium arsenate, 13 and 50, copper arsenite, 11 and 40, and copper aceto-arsenite, 11 and 90, respectively. Under the same conditions the amount of untreated leaf consumed was 150 mm^2. A formula is given for calculating the relative efficiency of insecticides over periods of from 20 to 96 hours after feeding on the poisoned material has commenced. According to this calculation, copper aceto-arsenite was the most effective, copper arsenite the next and triplumbic lead arsenate the least. The lethal dose of arsenic (As) was 5 microgrammes in the form of diplumbic lead arsenate and 2 microgrammes in the form of copper aceto-arsenite.

Mesnil (L.). **Insectes nuisibles aux grains entreposés.**—*Rev. Path. vég.* **21** no. 2–3 pp. 16–29, 2 pls. Paris, 1934. [Recd. July 1935.]

Lists are given of insect pests of stored grain, of comparatively harmless insects found in granaries, and of polyphagous pests that live in granaries but do not injure stored grain. Notes are given on the distribution, economic importance and bionomics of *Calandra granaria*, L., *Calandra oryzae*, L., and *Rhizopertha dominica*, F.

Dubois (R.). **Le miel de pays comme succédané de la mélasse dans la préparation des appâts empoisonnés utilisés dans la lutte anti-acridienne au Soudan Français.**—*Rev. Path. vég.* **21** no. 2–3 pp. 36–40. Paris, 1934. [Recd. July 1933.]

In the French Sudan, *Schistocerca gregaria*, Forsk., is mostly found north of 15° N. lat., while *Locusta migratoria migratorioides*, R. & F.,

is more injurious to the south of that latitude. The customary method of control is to use poison baits against crawling or stationary swarms. The bait consists of 8 lb. sodium fluosilicate, 12 lb. molasses and 200 lb. millet husks, horse dung or chopped grass. Local honey, three times cheaper than the molasses which had to be imported from Europe, was tried. In 1933 experiments in different places near Kita were made against *Locusta* with baits made according to varying formulae. The carrier was 200 lb. scrub-wood chopped into pieces 2–7 cm. long. The poison bait was placed in front of the locusts or in a circle round them at night. Honey was more attractive than molasses. To soak the carrier thoroughly it was necessary to mix the molasses with 14 gals. water, but the honey needed only 10. Baits prepared with honey kept moist better than those prepared with molasses. When honey was used, the amount of sodium fluosilicate could be reduced from 8 to 7 lb. without any decrease in the mortality. Baits prepared with 7 lb. sodium fluosilicate and either 12 or 10 lb. honey are equally poisonous. At the end of the winter season while there is still some green undergrowth for the locusts to feed on, it is best to use 12 lb. honey, but at the beginning of the winter season when there is little or no green food, 10 lb. would possibly make the bait attractive enough.

[Chugunin (Ya. V.) & Yuganova (O. N.).] **Чугунин (Я. В.) и Юганова (О. Н.). Phenological Calendar for Orchard Protection. Part I. Apple and Pear Trees.** [*In Russian.*]—Med. 8vo, 121 pp., 54 figs. Simferopol, Kruimgosizdat [1933]. Price 2 *rub.* [Recd. July 1935.]

This first part of a series deals with the protection of apple and pear trees from insect pests and diseases in the Crimea. The close relation existing between the phenology of the food-plant and the appearance of the injurious stages of various pests is dealt with. A table illustrates this relation in the case of apple. This is followed by notes on the development of the buds, flowers, fruit and foliage, and in a section of 40 pages specific information is given on 15 important insect pests of apple and pear, with particular reference to the significant stages in their development and the methods by which these times may be ascertained. A separate chapter deals with diseases, and 25 pages are devoted to control measures in relation to the phenology of the tree. The various mechanical and chemical control measures are, therefore, discussed in reference to the seasonal development of the tree. Notes are given on cultural methods of protecting orchards, the biological control of the woolly aphis [*Eriosoma lanigerum*, Hsm.], and the properties and application of stomach and contact insecticides and of fungicides. A programme of protective measures for orchards is outlined in a table showing the phenological condition of the tree, the pest or disease to be controlled, the injurious stage, the corresponding control measure and the time of its application.

[Chugunin (Ya. V.) & Yuganova (O. N.).] **Чугунин (Я. В.) и Юганова (О. Н.). A System of Measures for the Control of Orchard Pests and Diseases.** [*In Russian.*]—Med. 8vo, 16 pp. Simferopol, Gosud. Izd. Kruim ASSR, 1934. [Recd. July 1935.]

This programme of control measures to be applied against insect pests and diseases of fruit trees in the Crimea is arranged in tabular

form according to the phenological condition of the tree, and shows the approximate time of the application, the pest or disease against which the measure is directed (popular names only being given), their stage at the time of the treatment, the composition, concentration and amount of the insecticide or fungicide and the apparatus for applying it. Notes are appended on the preparation of the various sprays and on the technique of spraying and dusting.

[Chugunin (Ya. V.).] **Чугунин (Я. В.). Control of Orchard Pests.** [*In Russian.*]—Med. 8vo, 160 pp., 112 figs., 2 refs., 2 fldg tables. Moscow, OGIZ, 1935. Price 1 *rub.* 75 *kop.*

This handbook has been compiled for the use of pomologists and experts in the control of pests in the Russian Union and is divided into two parts, the first of which (pp. 4–64) comprises general accounts of agricultural, mechanical, chemical and biological control measures and notes on spraying and dusting equipment. General information is also given on the metamorphosis of insects, the different forms of Aphids, and the phenology of various fruit trees. The second part (pp. 65–156) contains notes on the morphology, bionomics, distribution in the country and control of a number of insects and of the mite, *Tetranychus telarius*, L., infesting fruit trees in the Russian Union. The pests are dealt with under their orders and the more important species are discussed in greater detail. A revision of the table on control noticed in the preceding paper is appended.

[Dryenski (P.).] **Дрѣнски (П.). Die Krankheiten und Schädlinge der Honigbiene in Bulgarien im Jahre 1933.** [Diseases and Enemies of Bees in our Country in the year 1933. (*In Bulgarian.*)] —Demy 8vo, 20 pp. Sofia, Publ. Bulg. apic. cooper. "Nectar." [1934.] (With a Summary in German.) Price 10 *leva*. [Recd. July 1935.]

Investigations in 1933 showed that bees in Bulgaria are attacked by some 30 species of diseases, pests and predators, an annotated table of which is given. It is estimated that their joint activity reduces the potential annual profit by 50–60 per cent. Brief accounts and in some cases recommendations for the control of the species that were most injurious during 1933 are given. The principal insects include the bee louse, *Braula coeca*, Nitz., and the wax-moths, *Galleria mellonella*, L., and *Achroia grisella*, F. A programme for the organisation of a campaign against diseases and pests is outlined.

[Dryenski (P.).] **Дрѣнски (П.). Diseases and Enemies of Bees and Means of curing and destroying them. After A. Ya. Kurochkin.** [*In Bulgarian.*]—Cr. 8vo, 112 pp., 25 figs., 1 ref. Sofia, Khr. G. Danov, 1932. Price 35 *leva*. [Recd. July 1935.]

This popular handbook, which is intended for the use of beekeepers in Bulgaria, has been compiled on the basis of a Russian manual and the French and German literature, the contents being adapted to Bulgarian conditions. It opens with brief general information on infectious diseases and instructions on the proper methods of beekeeping. An account of the various diseases that attack bees and of methods of control includes notes on *Acarapis woodi*, Rennie, the

causal agent of acarine disease, which is not known to occur in Bulgaria.

A separate chapter deals briefly with the enemies of bees, which include the Sphegid, *Philanthus triangulum*, F. (*apivorus*, Latr.), *Vespa crabro*, L., *Trichodes apiarius*, L., *Braula coeca*, Nitz. (which is very common in Bulgaria), *Formica rufa*, L., *Lasius niger*, L., *Monomorium pharaonis*, L., and *Hypocera* (*Phora*) *incrassata*, Mg., which oviposits into mature bee larvae. The combs are attacked by the larvae of the moth, *Galleria mellonella*, L., and of the beetle, *Dermestes lardarius*, L. The adults of the Sphingid, *Acherontia atropos*, L., and various species of wasps feed on the honey in the hives. The honeydew produced by Aphids is harmful to bees.

[Malyuta (D. A.).] **Малюта (Д. А.). Sphingids as Pests of Spurge.** [*In Russian.*]—*All Un. Inst. sci. Res. Oil Cult.* [Pub.] no. 7 pp. 81–84, 3 figs. Krasnodar, 1934. [Recd. July 1935.]

The cultivation of spurge (*Euphorbia lathyris*) has recently been started in the North Caucasus and the Ukraine on account of the high oil content of its seeds. In view of the proposed increase in the area under this crop, attention is drawn to the Sphingids, *Celerio* (*Deilephila*) *euphorbiae*, L., and *C.* (*D.*) *galii*, Rott., the larvae of which feed on the foliage of *E. lathyris*. The former species, which was the more common in the North Caucasus in 1933, only attacks *Euphorbia* spp., but the latter also occurs on *Crataegus oxyacantha* and *Galium verum*. In 1933 there were two overlapping generations of *C. euphorbiae*. The adults appear in the middle of June and eggs are laid in batches of 20–40 on the leaves. The period of oviposition is protracted, and all stages of the insect are found in the field throughout the summer. For the first few days the young larvae feed gregariously on the surface of the leaves. After about a week they spread all over the plant. In the laboratory, three larvae defoliated a whole plant of *Euphorbia* in 2–3 days. The larvae also injure the bolls. They reach maturity in 15–20 days and enter the soil, where they pupate 4–6 ins. below the surface. The duration of the pupal stage varies greatly according to meteorological factors. In 1933, the larvae of *C. euphorbiae* damaged 57–72 per cent. of the plants of *E. lathyris* in the centre of different experimental plots, and 88–100 per cent. at the edges. In preliminary experiments spraying with Paris green (0·08 per cent.) or lead arsenate (0·06 per cent.) killed few of the larvae. Since they feed on *Euphorbia*, the juice of which contains the highly toxic alkaloid euphorbin ($C_{30}H_{48}O$), it is possible that they may be immune to certain stomach insecticides, unless the dosage is increased to an extent that would injure the plants.

[Dryenski (P.).] **Дрѣнски (П.). Krankheiten und Schädlinge der Getreidepflanzen in Bulgarien.** [Diseases and Pests of graminaceous Plants in Bulgaria.] [*In Bulgarian.*]—Med. 8vo, 54 pp., 38 figs. Sofia, 1930. (With a Summary in German.) [Recd. July 1935.]

Notes are given on the biology and control of 41 species of diseases and pests (including 27 injurious insects) attacking wheat, rye, barley, oats, maize and rice in Bulgaria. Of the insects, the most injurious are *Pyrausta nubilalis*, Hb., and *Byrsocrypta gallarum*, Gmel. (*Tetraneura ulmi*, DeG.), on maize, *Corcyra cephalonica*, Stn., on rice,

Cantharis rustica, Fall., on rye, *Epicometis* (*Tropinota*) *hirta*, Poda, *Euxoa* (*Agrotis*) *segetum*, Schiff., *Zabrus balcanicus*, Heyd., *Amphimallus* (*Rhizotrogus*) *solstitialis*, L., *Oscinella* (*Oscinis*) *frit*, L., and *Agriotes lineatus*, L., on wheat, rye, barley and oats, *Sitotroga cerealella*, Ol., *Ephestia kühniella*, Zell., and *Calandra granaria*, L., in stored grain and maize, and *C. oryzae*, L., in stored rice. In Bulgaria, *E. segetum* is parasitised by *Eudoromyia* (*Echinomyia*) *magnicornis*, Zett. (*tessellata*, F.), *Meteorus rubens*, Nees, and *Tachina* sp.

BARNES (H. F.). **On the Gall Midges injurious to the Cultivation of Willows. II. The so-called " Shot hole " Gall Midges** (*Rhabdophaga* **spp.**).—*Ann. appl. Biol.* **22** no. 1 pp. 86–105, 4 pls., 3 figs., 4 refs. Cambridge, February 1935.

As the identification of gall-midges that do not cause swellings but live in the stems of willow is difficult, this study [*cf. R.A.E.*, A **20** 443] includes a discussion of records of these species from the literature. *Rhabdophaga saliciperda*, Dufour, all stages of which are redescribed, has been said to infest many species of willow, but apparently it only attacks *Salix caerulea*, *S. fragilis* and *S. alba*. There is one generation a year. In England the adults emerge from late April until early June. The species reproduces by means of unisexual families. The eggs are laid on the stubs and branches, and the larvae live in clusters each in its own chamber.

Three new species are described from England, *R. triandraperda* from *S. triandra* and *R. purpureaperda* and *R. justini* from *S. purpurea*. Attempts to rear these species on other species of *Salix* than those from which they are here recorded failed, but in one case larvae of *R. justini* were found on *S. purpurea* × *viminalis*. Both *R. triandraperda* and *R. purpureaperda* have one generation a year and reproduce by means of unisexual families. The adults of the former species emerge from the middle of April to the beginning of June according to the season. Most of the eggs are laid within 10 hours of emergence. Virgin females have been kept alive for 5½ days but fertilised ones usually die within 48 hours of emergence. In 1928 incubation took 10–13 days. The larvae lie for nearly a year more or less bathed in sap in cavities in the tissue below the skin of the plant. The pupal period lasts one or two weeks. Usually no swelling is apparent. The adults of *R. purpureaperda* emerge from mid-April to early July. Its life-history broadly resembles that of *R. triandraperda*. The egg-stage takes 6–12 days, the larval stage 10–11 months and the pupal stage about 14 days. The adults live for about 36 hours. In one case a female of *R. purpureaperda* was induced to mate with a male of *R. triandraperda* but the eggs laid were sterile. *R. justini* has normally two broods a year but there is sometimes a partial third generation. Adults of the overwintering generation emerge from the end of April to the beginning of June. In normal seasons the second flight of midges occurs in July but the adults of this generation may sometimes emerge during the second half of June. In such abnormal years a partial third generation may occur in the first part of August, as was the case in 1933. The eggs are usually laid in the stems but occasionally on the leaves. Unlike the other three species, *R. justini* does not ordinarily lay its eggs in batches. This species also reproduces by unisexual families.

As *R. justini* has more than one brood, the larval chambers occur and weaken the rods throughout their length, whereas damage by *R. triandraperda* and *R. purpureaperda* is limited to the stubs and bases of the shoots. *R. saliciperda* injures the stubs, branches and the current year's growth as well as old shoots. It spoils *S. caerulea* grown for sets. Birds, ripping up the bark in search of the larvae, increase the damage done by all four species. If all infested shoots were burnt at the same time, tarring the stubs might be successful against all these species except *R. justini*, the summer brood of which is not limited to the base of the shoots. In serious infestations by this species the entire crop of rods for the year should be burnt. Cutting down the new growth in May should reduce the numbers of the midges, if, like *S. purpurea*, the variety of willow grown can recover from this treatment. Where *S. caerulea* is grown, *S. fragilis*, which serves as a reservoir for *R. saliciperda*, should be destroyed.

The following parasites have been reared: *Torymus* sp. near *auratus*, Boy., *Eurytoma aciculata*, Ratz., *Tridymus salicis*, Nees, *Tetrastichus flavovarius*, Nees, *T. roesellae*, DeG., and *Platygaster* (?) *philinna*, Wlk., from *R. triandraperda* in Suffolk, and *Tridymus salicis*, *Platygaster cecidomyiae*, Ratz., *Tetrastichus flavovarius* and *Eurytoma saliciperdae*, Mayr, from *R. saliciperda* in Kent or Berkshire. In Lancashire *Pleurotropis* (?) *caenus*, Wlk., *Tetrastichus roesellae* and *Platygaster* (?) *philinna* were reared from gall midges from *S. purpurea*, but it was not determined whether the host in the various cases was *R. purpureaperda* or *R. justini*.

DAVIES (W. M.). **Studies on Aphides infesting the Potato Crop. III. Effect of Variation in Relative Humidity on the Flight of** *Myzus persicae*, **Sulz.**—*Ann. appl. Biol.* **22** no. 1 pp. 106–115, 5 graphs, 5 refs. Cambridge, February 1935.

In further studies in Wales [*cf. R.A.E.*, A **22** 386, etc.] it was found that in South Caernarvonshire the number of individuals of *Myzus persicae*, Sulz., on 100 potato leaves never exceeded 90 and was usually less than 40, whereas in Flintshire the numbers ranged from 500 to 1,300. Similar results were obtained by trapping other alate migratory Aphids. The only great meteorological difference between the two areas is that South Caernarvonshire has a high humidity. A series of experiments, the technique of which is described, showed that at temperatures above 55°F., which is about the minimum daytime temperature in June and July, relative humidities exceeding 70 per cent. greatly reduced the flight of *M. persicae*. At 55°F., the Aphids are sluggish and variations in humidity have little effect on flight. They hardly flew at all at temperatures of 80 and 90°F., if the humidity was above 85 per cent. These results are correlated with those of the previous surveys. Where data have been available, it has been shown that in the centres where initial infestation of potatoes was low, high relative humidities prevailed, and, as these experiments indicate, inhibited the migration of winged forms. In 1933 the population of *M. persicae* was higher (90 per 100 leaves) in south Caernarvonshire than it had been for five years. In June of that year the mean value for relative humidity was lower than it had been at any time during the five preceding years.

Miles (H. W.). **Biological Studies of certain Species of** *Caliroa* **Costa and** *Endelomyia* **Ashmead (Hymenoptera Symphyta).**—*Ann. appl. Biol.* **22** no. 1 pp. 116–133, 2 pls., 3 figs., 24 refs. Cambridge, February 1935.

The author considers *Caliroa* and *Endelomyia* to be distinct genera. He gives a key to the British species and redescribes the adults and larvae of *C.* (*E.*) *aethiops*, F., *C. limacina*, Retz., and *C. annulipes*, Klug. In Lancashire and Cheshire during 1928–34 adults of *C. limacina* were on the wing from early June to late August. The eggs are laid in the leaves of pear and cherry. In the laboratory it was found that more eggs were laid on pear. Insects in captivity lived 6–8 days and laid 40–50 eggs. The incubation period varied from 9 to 14 days. The larvae moult 6 times, reach maturity in 18–21 days and pupate in the soil. Larvae of the first generation sometimes remain in the prepupal stage until the following year, but the high temperatures in June and July apparently caused them to pupate quickly and produce another generation of adults within 4–5 weeks. The pupal stage lasts 2–3 weeks. In breeding experiments since 1928 only one male has occurred. The adults of the first generation of *C. annulipes* are on the wing in May and July. The eggs, which are laid in the leaves of *Salix* spp., *Crataegus oxyacantha* and cherry, hatch in 13–15 days and the larvae mature in 19–22 days and pupate in the soil. Larvae of the second generation hibernate in the cocoons. Males were frequent in both generations and the species does not entirely depend on parthenogenesis. *C. aethiops* has one generation a year and hibernates as a prepupa in the cocoon. Males are very rare. The females, which are on the wing in May–June, oviposit in the edges of rose leaves. The eggs hatch in 9–14 days. The larvae feed for 20–27 days and moult 5 or 6 times.

Bliss (C. I.). **The Calculation of the Dosage-Mortality Curve.**—*Ann. appl. Biol.* **22** no. 1 pp. 134–167, 3 figs., 14 refs. Cambridge, February 1935.

The following is taken from the author's summary. Toxicological studies upon a large variety of organisms have established the sigmoid character of the typical dosage-mortality curve, especially in the case of multicellular forms. It has recently been shown that such curves can be plotted as straight lines, thus facilitating their subsequent analysis [*R.A.E.*, A **22** 440]. The present paper is concerned with the calculation of the transformed dosage-mortality curve and its accuracy. Statistical methods are described for taking account of tests which result in 0 or 100 per cent. kill, for giving each determination a weight proportional to its reliability, for computing the position and slope of the transformed dosage-mortality curve, for measuring the goodness of fit of the regression line to the observations, and for calculating the error in position and in slope and their combined effect at any logarithmic dosage. The terminology and procedures are consistent with those used by R. A. Fisher, who has contributed an appendix on the case of zero survivors. A numerical example selected from Strands' experiments upon *Tribolium confusum*, Duv., with carbon bisulphide [**20** 60] has been worked out in detail.

HAMILTON (M. A.). **Further Experiments on the Artificial Feeding of *Myzus persicae* (Sulz.).**—*Ann. appl. Biol.* **22** no. 2 pp. 243–258, 1 fig., 8 refs. Cambridge, May 1935.

Experiments were undertaken to determine the volume of liquid imbibed by Aphids when feeding, whether any foreign body in true or colloidal solution would be passed through the blood stream into the salivary glands and ejected into the feeding substance, the quantity of foreign body ejected and the volume of liquids involved in the ejection of these quantities. It was consequently necessary to devise a technique by which the Aphids could be induced to feed fairly consistently, and to find a substance (called an indicator) which, though not injurious to them, could be detected in solution in very small quantities of liquid. The apparatus for feeding was a variation of one already described [*cf. R.A.E.*, A **18** 667]. Small glass rings were used instead of capsules, and instead of animal membranes the feeding surface was formed by the epidermis of cabbage leaves from which the leaf tissue had been removed. The rings were prepared by dipping one edge into molten paraffin wax and then sealing the epidermis on with the dry surface inwards and enclosing the whole in an inverted petri dish the lid of which served as a base for the capsule. The best medium to carry the indicator proved to be 3 per cent. agar with 20 per cent. saccharose, the agar being used to prevent the passage of the solution through the membrane when it was pierced by the insects. A radioactive substance, polonium, was used as the indicator, and the method of employing it is described. The results show that *Myzus persicae*, Sulz., picks up the indicator from the medium and transmits it to a leaf on which it is subsequently fed. The volumes imbibed are of the same order of magnitude as those imbibed by Aphids under natural feeding conditions. A constant proportion of the amount of polonium imbibed is transferred to the leaf, from which it is deduced that the polonium is transmitted through the bodies of the Aphids and not on the outsides of the stylets. The failure to transmit a virus by artificial feeding suggests that this may also be true for the virus. The theory that the presence of the salivary sheath prevents transmission on the outside of the stylets could be applied to virus and polonium in the plant or in artificial media. This may explain the fact that not all species of Aphids which feed on an infected plant transmit the virus. It is probable that the virus can only survive the action of digestive juices and excretory mechanisms in a small number of species. No evidence has been found to upset the hypothesis that the mechanism of transmission for virus and polonium is essentially the same.

BARNES (H. F.). **Notes on the Timothy Grass Flies (*Amaurosoma* spp.).** —*Ann. appl. Biol.* **22** no. 2 pp. 259–266, 24 refs. Cambridge, May 1935.

A brief review of the literature on *Amaurosoma armillatum*, Zett., and *A. flavipes*, Fall., followed by notes on their distribution, introduces this account of experiments in southern England during 1932–34. From a small number of overwintered puparia, flies emerged in May in 1932, and between 11th April and 4th May in 1933. *A. armillatum* seemed to emerge a little before *A. flavipes*. Preliminary experiments indicated that the flies can live at least 10 days. They fed readily

on sugar water, but in one case a male attacked an adult female of *Rhabdophaga triandraperda*, Barnes. *A. armillatum* appears to be the more common species, as the adults of this species reared in the experiments were twice as numerous as those of *A. flavipes*. The eggs are usually laid on the upper surface of the leaf-blade of *Phleum pratense*. There is usually one egg on a leaf, but three have occasionally been found. On hatching the larvae work their way down to the ear, which is about 1 cm. long or less, and bore through the sheaths. They feed on the ear, and get carried up with it as it grows as far as the flag leaf sheath. The larvae have never been observed feeding on the ear after it has burst through the sheath. The larval stage lasts about 3 weeks, and pupation usually occurs in the soil, though occasionally puparia have been found in the sheath, and these either fall to the ground or are carried there with the dying grass. In 1932 puparia were first found on 24th June. The parasites reared were *Microbracon exhilarator*, Nees, and *Lamprotatus* sp., of which the latter appeared to be more common. The average percentage of infestation of samples of infested grass was 64·5 in 1932 and 38 in 1933, but the lower figure may be due to the fact that the plants were grown in a different area. The early strains appear to be less liable to attack in an early season, but there may be some varietal resistance in addition. It is apparently impossible to obtain strains which will flower throughout the period of insect attack. In preliminary experiments on the effect of manuring, 37 per cent. of plants that had been manured were attacked as compared with 54·5 per cent. of plants that had not been manured. But it is possible that this beneficial effect is limited to the beginning of the season.

King (L. A. L.), Meikle (A. A.) & Broadfoot (A.). **Observations on the Timothy Grass Fly** (*Amaurosoma armillatum* **Zett.**).—*Ann. appl. Biol.* **22** no. 2 pp. 267–278, 2 figs., 5 refs. Cambridge, May 1935.

In view of the damage caused to heads of timothy grass (*Phleum pratense*) by *Amaurosoma armillatum*, Zett., in the west of Scotland [*cf. R.A.E.*, A **21** 427] resulting in a loss of 25–30 per cent. of the seed in two counties, studies on its bionomics and control were carried out during 1931–34. All stages of the insect and the nature of the damage it does are described. In the field in Stirlingshire and Perth, eggs were found in May and adults from mid-May to early June. Eggs taken into the laboratory on 15th May (1933) hatched on 23rd May ; in 1932 and 1934 eggs laid by caged flies hatched in 4–6 days. After 15 days, during which they pass through three instars, the larvae bury themselves in the ground at a depth of 1–2 in., and change into pupae within 3–4 days, though the transformation may be delayed as long as 14 days. Even in the laboratory flies do not emerge until the next spring. There is only one generation a year. From a puparium obtained in 1931, a Pteromalid, *Seladerma laetum*, Wlk., emerged on 20th April 1932, and from 32 puparia kept through the winter of 1933–34, 30 examples of this parasite emerged from late April to mid-June. Two individuals of a Braconid, *Dacnusa semirugosa*, Hal., emerged in early June. Deep ploughing as a means of control is unsuitable in these areas, where the grass is grown mainly as a perennial crop. Measures against the pupae, such as running poultry on the land after harvest and heavy rolling during the dormant season,

require investigation. As the flies are active over a short period and only attack the inflorescence before it has emerged from the leaf sheath, the application of phosphatic fertilisers to hasten the emergence of the inflorescence was tested in the field. On plots which received on 16th or 17th February 1933 basic slag with ammonium sulphate, superphosphate with ammonium sulphate, basic slag alone, and ammonium sulphate alone on the control the percentage of plants bearing eggs on 3rd June were 30, 20, 15·7 and 24, respectively. The superphosphate and basic slag were applied at the rate of 2 cwt. per acre and the ammonium sulphate at the usual rate of 3½ cwt. per acre. At a later date the average percentages of plants showing damaged heads on the same plots were 41·75, 42·25, 23·83, and 41·75, respectively. On plots which had not received ammonium sulphate the plants were pale in colour and not more than 2 ft. high, shooting had begun, and many weeds were present, whereas on the plots which had received ammonium sulphate the plants were green and 2 ft. 8 in. high and there were few weeds, but shooting was retarded. The conclusion that the addition of ammonium sulphate increases susceptibility to attack was confirmed in 1934 when eggs were found on 32 per cent. and damaged heads on 24·7 per cent. of plants in one field treated with 5 cwt. ammonium sulphate per acre, whereas in an adjoining field treated with 2½ cwt. per acre the corresponding percentages were 20 and 15·9. The lighter dressing produced much shorter heads, 1½ in. as compared with 3 in. In 1933 preliminary experiments, sprays of paraffin, crude naphthalene emulsion and flake naphthalene emulsion, and a lime-creosote dust produced an apparent decrease in attack. Further experiments were undertaken in 1934 with a lime-creosote dust made by mixing 3½ lb. lime with 2 per cent. of its weight of creosote, a proprietary spray containing about 3 per cent. tar acids and diluted 1 : 80, and two emulsions, one made by mixing 2 fl. oz. crude creosote separately with 18 fl. oz. ground nut oil, and emulsifying with 3 fl. oz. ammonium oleate and 7 fl. oz. water, the whole being diluted to 6 gals., and the other made in the same manner but with naphthalene instead of creosote. The sprays were applied on 11th May, and by 23rd May oviposition had begun. Eggs were counted on 26th May and 1st June and damaged heads on 2nd July. The naphthalene emulsion proved the most satisfactory and reduced the average percentage of eggs from 27·5 on the control to 10·0 on the sprayed plot and the average number of damaged heads from 19·25 to 7·25. A second application made on some of the plots on 1st June produced no marked effect. It is recommended that grass to be kept for seed should be marked off early in the season and sprayed in mid-May about the time of oviposition, and that as soon as eggs appear on the rest of the field a second spraying should be given.

HERFORD (G. V. B.). **Studies on the Secretion of Diastase and Invertase by *Empoasca solana*, DeLong (Rhynchota, Homoptera, Jassidae).** —*Ann. appl. Biol.* **22** no. 2 pp. 301–306, 5 refs. Cambridge, May 1935.

The following is substantially the author's summary of laboratory experiments carried out in Hawaii with *Empoasca solana*, DeLong, in which he showed that the adults and nymphs of this Jassid are able to eject diastase into the feeding medium. This diastase, besides being secreted in the salivary glands, is apparently also formed by

certain yeasts which are regurgitated from the gut of the insects. The technique of the experiments and a method of feeding the leafhoppers on a liquid are described. The insects have also been shown to be capable of secreting an enzyme, probably invertase, which has the power of inverting pure sucrose.

Bliss (C. I.). **The Comparison of Dosage-mortality Data.**—*Ann. appl. Biol.* **22** no. 2 pp. 307–333, 5 refs. Cambridge, May 1935.

The following is mainly taken from the author's summary: The theoretical and practical applications of the dosage-mortality curve usually involve either a comparison of similar series of records to determine whether they differ significantly, or the estimation of the dosage corresponding to a selected or observed mortality and the error of this estimate. In an earlier paper [*cf. R.A.E.*, A **22** 440] the author considered the methods appropriate for computing the dosage-mortality curve as a straight line and for measuring its error of estimation. The present paper [*cf.* **23** 493] is an extension of these methods to cover some of the more frequent applications of the curve. In measuring the degree of agreement between different series of dosage-mortality data, it is convenient to refer to one series, which has been transformed into a straight regression line of known accuracy, as the standard, and to determine the agreement of similar or smaller groups of data with this standard. The author discusses in detail the calculations necessary when the standard curve is of absolute accuracy, when it has been determined from homogeneous data (in which the only source of error is variation in the susceptibility of test insects sampled at random), and from heterogeneous data (in which the variation is found to be statistically greater than that which can be attributed to such variation). In expressing the relative susceptibilities of different biological races or species, or the relative potencies of toxic agents, the comparisons are in terms of dosages required to produce selected or observed mortalities rather than of mortalities produced by specified dosages. When the mortality is chosen by the experimenter, the dosage estimated from the standard curve is subject only to the errors involved in its determination. When the mortality at which the dosages in a standard and a second series are to be related is determined by experiment, there is not only the error of the standard curve to be considered, but also the error in the mortality observed with the unknown which is being standardised. The error in mortality observed in the experiments represented by the second curve is discussed, and a method proposed for determining the ratio of potencies and the error in this ratio for all the types of experiment dealt with.

Martin (H.). **The Standardisation of Petroleum and Tar Oils and Preparations as Insecticides.**—*Ann. appl. Biol.* **22** no. 2 pp. 334–414, 1 fig., 74 refs. Cambridge, May 1935.

In view of the growing demand for products of a reasonable standard of efficiency and uniform quality, agreed specifications and methods of analysis have been drawn up for some of the simpler insecticides and fungicides in general use [*cf. R.A.E.*, A **22** 602]. The author undertook to draw up similar data for tar and petroleum oils and preparations. The oils are defined and classified and criteria selected from

their physical and chemical properties to be used as the basis of the specification. These properties, methods for the determination of which are described, are correlated with the insecticidal action and phytocidal properties of the various oils from a survey of controlled experiments. The status of certain oils and preparations under the proposed specifications is described and shown in tables.

Miller (D.) & Clark (A. F.). *Sirex noctilio* (**Hym.**) **and its Parasite in New Zealand.**—*Bull. ent. Res.* **26** pt. 2 pp. 149–154, 1 pl. London, June 1935.

Sirex noctilio, F., was first recorded in New Zealand in 1900 where it attacks *Pinus* spp. [*cf. R.A.E.*, A **22** 87] and *Larix europaea*. Reasons for its widespread occurrence in New Zealand, where it is potentially dangerous, are discussed. It infests suppressed, dead and dying trees, stumps, and trees damaged by fire or fungi and renders them susceptible to the attacks of *Hylastes ater*, Payk. The fungi, *Botryodiplodia pinea* and *Stereum sanguinolentum*, attack several species of pine and may be connected in some way with the presence of *S. noctilio* on these trees. Between December 1928 and April 1929 and March and August 1931, 19 consignments amounting to 7,830 individuals of the parasite, *Rhyssa persuasoria*, L., were received from England. The technique of transporting and rearing the parasite is described in some detail. The shipments were satisfactory except that moulds damaged the 160 larvae packed in glass tubes. Sawdust provided more suitable conditions of moisture and temperature than cottonwool. Some pupae packed in metal containers placed on ice developed and produced adults at 41°F. About two-thirds of the adults from this consignment were males, and many of the females had damaged ovipositors. The adults were sluggish at 40°F., at 56°F. they fed and at 60°F. became normally active. They paired at 64°F. and above this temperature reached their maximum activity. From the 1928–29 and 1931 consignments totals of 88 and 117 adults respectively were liberated in infested plantations. Pairing had already taken place in the insectary, and the females began to oviposit almost at once. In the spring of 1932, 26 females were produced from 365 larvae which had overwintered in cool store and were liberated in October–December. Rearing was undertaken in the laboratory in 1931. Females were allowed to oviposit in infested logs. Two generations were produced in September 1932 and September and October 1933. The life-cycle occupied $10\frac{1}{2}$ months. The insects were larger than the English stock, and those of the second generation were bigger than those of the first. The New Zealand strain of *S. noctilio* is also larger than the English. Males predominated in both generations. From 21 larvae of another parasite, *Ibalia leucospoides*, Hochenw., sent from England only one male emerged.

MacGill (E. I.). **On the Biology of** *Dysdercus howardi*, **Ballou** (**Hem.**). —*Bull. ent. Res.* **26** pt. 2 pp. 155–162, 7 refs. London, June 1935.

The following is based on the author's summary of laboratory experiments in Manchester with *Dysdercus howardi*, Ballou. The length of the life-cycle was about 32 days at 27°C. [80·6°F.]. At the same temperature pairing took place about 2·8 days after the females

emerged, and oviposition began 5–6 days after pairing. The average number of eggs laid by one female was 141·9 and the average number of batches 2. The number of adults obtained was about 16 per cent. of the number of first stage nymphs. Mortality appeared to be highest among the fifth stage nymphs. The ratio of females to males was 1 : 1·27. On an average the females lived for 11 days. These results are compared in a table with available data on the bionomics of other species of *Dysdercus*.

WOMERSLEY (H.). **On the Name of the " Blue Oat Mite " of Australia.**—*Bull. ent. Res.* **26** pt. 2 p. 163. London, June 1935.

A comparison of *Penthaleus bicolor*, Froggatt, from Australia with specimens of *P. major*, Dug., from Europe [*cf. R.A.E.*, A **20** 508] has confirmed the author's opinion that *P. bicolor* is a synonym of *P. major* [*cf.* **22** 265]. Other synonyms of *P. major* are *P. haematopus*, Koch, *P. erythropus*, Koch, and *P. insulanus*, Thorell.

PILAT (M.). **Histological Researches into the Action of Insecticides on the Intestinal Tube of Insects.**—*Bull. ent. Res.* **26** pt. 2 pp. 165–180, 4 pls. London, June 1935.

These experiments were carried out in Leningrad in 1932 and 1933. Sodium fluoride, sodium fluosilicate, sodium and calcium arsenites, and Paris green were tested, in the form of solutions and powders spread on leaves, on the larvae of *Locusta migratoria*, L., and of three species of Lepidoptera. The author concluded that the final effect of the insecticides shows itself in the disintegration and destruction of the epithelium of the mid-intestine. This destruction is preceded by the exfoliation of the epithelium from the subjacent connective membrane. The histological picture of the intestinal epithelium at the first moment of the action of the poison shows certain peculiar features if compounds of fluorine are used. The histological picture of the intestinal tube of the poisoned insect corresponds with the picture of the haemolymph of the same insect.

MYERS (J. G.). **Second Report on an Investigation into the Biological Control of West Indian Insect Pests.**—*Bull. ent. Res.* **26** pt. 2 pp. 181–252, 1 map, 91 refs. London, June 1935.

This lengthy second report [*cf. R.A.E.*, A **19** 627] of investigations from September 1930 to March 1934 is introduced by some remarks on general aspects of biological control. An account is given of the ecological conditions of each of the regions visited in north-eastern South America, Panama, Florida and the West Indies. A section on particular insect pests is arranged according to crops and contains notices of the introduction of parasites. A summary of results and recommendations is appended.

ULLYETT (G. C.). **Notes on *Apanteles sesamiae*, Cam., a Parasite of the Maize Stalk-borer (*Busseola fusca*, Fuller) in South Africa.**—*Bull. ent. Res.* **26** pt. 2 pp. 253–262, 6 figs., 4 refs. London, June 1935.

In 1933 a preliminary study of *Apanteles sesamiae*, Cam., was begun. It is the only important parasite of *Busseola fusca*, Fuller (maize

stalk-borer) in the eastern Transvaal. The male and female are described, and the morphology of the last stage larva of the parasite is dealt with in detail. Between 12 and 120 fully grown larvae may emerge from a single host, which is invariably in its 5th or 6th larval stage. The cocoons, which give rise to both sexes, are spun within the lumen of the maize stalk, often surrounding the host. At 26°C. [78·8°F.] and 80 per cent. relative humidity the pupal period occupies 5–7 days. Dry conditions are detrimental to the pupa. In the laboratory, direct sunlight was not essential for pairing, which took place soon after emergence, but a well-lighted position gave rise to most activity. Without food the adults died within 24 hours, but their life was only slightly increased if they were fed on raisins or sugar solution. Both sexes could be kept alive for 3–4 days by feeding them on the cut ends of maize stalks. In the field the female enters the larval burrow of the host and parasitises it. Successful parasitism was only obtained in the laboratory when sections of maize stalks in which artificial burrows and entrance-holes had been made were used. They were more attractive after the borer had fed and a little frass had accumulated. The location of the host appears to depend on olfactory stimulus. The period from oviposition to the emergence of the fully grown parasite larva varies from 14 to 21 days according to the temperature. Parasitised larvae fed more voraciously than healthy ones, and the later stages were prolonged. After the parasites emerged, the hosts fed little and died without pupating.

In order to determine the efficiency of the parasite in the field and the most profitable time to make large-scale collections of the host, larvae and pupae of the borer were taken from 22 per cent. of the plants in each maize field when general observations showed that *B. fusca* was most numerous. At the end of February 4·7 per cent. of the plants were infested and 2·9 per cent. of the borer larvae were parasitised. A week later 4·14 per cent. of the plants were infested and the percentage of parasitism was 22·8 per cent. At the end of March, the corresponding figures were 0·5 and 59·1. Only one species of hyperparasite was found. It attacked the pupa of *Apanteles*, but it was present in only 2 per cent. of the cocoon-masses and appeared rather late in the season.

With a view to its shipment to Canada for trial against *Pyrausta nubilalis*, Hb., fresh pupae of *A. sesamiae* were subjected to 18–22°F. and 38–44°F. in an incubator for 17 and 21 days respectively. These are the conditions under which parasites would be transported in a ship's cold store to England. At the higher range of temperature the pupae developed slowly and matured in 24 hours when gradually brought into higher temperatures, but the resulting adults were too weak to cut their way out of the cocoon. The lower range of temperature retarded development more but no emergence took place on removal. Further tests with pupae in all stages of development and prepupae showed that it was impracticable to send consignments under these conditions. As the parasite larvae are within the host for at least 14 days, it proved possible to send parasitised borer larvae by air. The material carried well and the parasites pupated after arrival. When parasitised larvae were exposed to 18–22°F. for a period equivalent to the length of the voyage from England to Canada, the host larvae died after a few days' exposure to the lower range of temperature. The development of the parasites was retarded sufficiently at 38–44°F. to allow the material to arrive

before pupation occurred. These results were confirmed when pieces of maize stalk containing parasitised larvae were sent to Canada via England. A comparison of the effect of low temperatures on parasite and host seems to indicate that the threshold of development of the former is lower than that of the latter. From laboratory observations and from the fact that the parasite is found in South Africa where hard frosts are common between June and August, it is considered that the pupae of *A. sesamiae* are able to withstand a severe winter.

Rivnay (E.). **Ecological Studies of the Greenhouse Thrips, *Heliothrips haemorrhoidalis*, in Palestine.**—*Bull. ent. Res.* **26** pt. 2 pp. 267–278, 7 figs. London, June 1935.

In these experiments, the technique of which is described, with *Heliothrips haemorrhoidalis*, Bch., the effect of humidity alone upon the rate of development of the egg, larva, and pupa was found to be practically negligible. A relative humidity of at least 75 per cent. was necessary for the pupa to complete its development. The rate of development and reproduction primarily depends upon temperature. At 25°C. [77°F.] there is very little difference in the rate of development whether the relative humidity is 75 or 87 per cent., but at 18–19°C. [64·4–66·2°F.] the pupa completes its development in 8 days at a relative humidity of 87 per cent. and in 9·5 days at 75 per cent. This makes a difference of about 15 per cent. in the total time of development. All stages developed most quickly at a temperature of 26–28°C. [78·8–82·4°F.]. The Blunck-Bodenheimer formula [*cf. R.A.E.*, A **13** 389] agrees with the data only within the temperatures of 17–26°C. [62·6–78·8°F.]. Within these limits the threshold of larval development was 13·2 and the thermal constant 117. Under favourable conditions one individual may deposit 2 eggs in a day, but between 13–15°C. [55·4–59°F.] only 5 eggs were laid in 1 month. The frequency of oviposition increased as the temperature rose. An average of 47 eggs were laid by 1 female at the optimum temperature of 21–28°C. [69·8–82·4°F.]. The maximum was about 62. The larva and adult are more resistant than the egg and pupa to the combined effects of unfavourable temperature and humidity. Among eggs on plants placed in the open, in a room and in a cellar, where the average temperatures were 29°C. [84·2°F.], 27·5°C. [81·5°F.] and 25°C. [77°F.], respectively, the mortalities were 47·5, 27·6 and 15·4 per cent. At and below 60 per cent. relative humidity pupae died before maturing, but at 87 per cent. all individuals survived. At humidities of 75 and 81 per cent., the percentage that survived varied with the temperature. Above 21°C. [69·8°F.] 25 per cent. died and below 20°C. [68°F.] the ratio of dead to living individuals was 13 : 17. Individuals reared in test tubes lived 55 days, whereas those reared on uncovered plants lived 35 days. This difference was probably due to the humidity, which was 85 per cent. in the test tube and 60–70 per cent. round the plants. At 18–20°C. [64·4–68°F.] the individuals reared in test tubes lived 110 days, but at 25–27°C. [77–80·6°F.] they lived 55 days. Under optimum conditions of temperature and humidity, *H. haemorrhoidalis* can survive 10–15 days without food, so that if an insect dies after 1 or 2 days unfavourable conditions of humidity or temperature are probably the cause. At a humidity above 85 per cent. and temperature below 29°C. [84·2°F.] adults survived for more than 9 days without food and all the pupae gave rise to adults. A

table shows the correlation of temperature with activity. *H. haemorrhoidalis* primarily attacks *Citrus*. When an egg has been deposited under the epidermis of a leaf, the cells in the sponge tissue produce a layer of cork, which cuts it off from the surrounding tissue. Under conditions of high temperature and humidity these cork cells may multiply rapidly and either crush the egg or burst the epidermis and push the egg out of the leaf. Experiments to find when such reactions take place were carried out with plants placed in various temperatures and the percentages of eggs which hatched were estimated. Graphs show the effects of the climate in Palestine on the abundance of larvae and adults throughout the year.

Nicol (J. M.). **Notes on the Galleriid Moth** *Corcyra cephalonica* **Stainton.** —*Ent. mon. Mag.* **71** no. 854 pp. 153–156, 1 fig., 3 refs. London, July 1935.

Larvae of *Corcyra cephalonica*, Stn. [*cf. R.A.E.*, A **18** 174] have recently been found in large numbers in samples of Venezuelan cacao sent to Great Britain in closed tins. All stages are described. In studies on its life-cycle [*cf.* **7** 428], the egg, larval and pupal stages lasted 7, 80 and 10 days at 77°F., and 8, 85 and 10 days at 72°F. The larva feeds voraciously, and its frass serves to distinguish it from *Ephestia elutella*, Hb. *C. cephalonica* feeds on a wide range of stored products including locust beans [*Ceratonia siliqua*], apparently a new record.

Munro (J. W.). *Ephestia elutella* **in Rhodesian Tobacco.**—*Rhod. agric. J.* **32** no. 6 pp. 395–396. Salisbury, June 1935.

Studies on Rhodesian tobacco at Slough show that normal dosages of hydrocyanic gas in fumigation [*cf. R.A.E.*, A **20** 397] are too low to poison all stages of *Ephestia elutella*, Hb., in bales and hogsheads of tobacco. When infestation had been high in the packing sheds it was found to remain correspondingly high after the tobacco had been placed in London warehouses. The normal dosage of 16 oz. HCN per 1,000 cu. ft. should therefore be increased to 24–30 oz. These dosages can be given without affecting aroma, flavour or smoking qualities.

Uvarov (B. P.). **Locusts and a rational Anti-locust Policy.**—*Emp. Cott. Gr. Rev.* **12** no. 3 pp. 193–198. London, July 1935.

The importance of locusts is shown by the magnitude of the sums spent on their control. Thus over £11,000,000 was spent in Argentina during the period 1897 to 1933, while in the Union of South Africa, £1,125,000 was spent from 1920 to 1928. The locust problem is common to all continents, and everywhere the areas covered by locusts in their migrations are very great, the swarms arising in one country soon spreading beyond its borders and invading whole continents. The necessity for international co-operation in locust control has often been stressed, but the co-operation suggested aimed at the control of swarms spread over large areas. The cost of such wide defensive measures would be almost incalculable, and they cannot be expected to give definite results. Recent studies on the locust problem in Africa [*R.A.E.*, A **22** 701, 704] proved that the outbreaks of locusts always commence in relatively small areas, the so-called outbreak

centres. The policy now actively pursued in Africa aims at the discovery of these centres, and at the prevention of incipient outbreaks at their source. The cost of such a preventive policy is expected to be well under that required for attempts to control swarms when they have already spread over several countries. The experience of the last few years shows that the solution of the locust problem depends on a broad organisation of research into the original sources of outbreaks. This scheme can be successful only if there is an effective international co-operation. Such co-operation already exists between most of the African countries, and it is hoped that the Fourth International Locust Conference to be held at Cairo in 1936 will serve to extend the international anti-locust schemes to all countries suffering from locusts.

Smee (C.). **Report of the Entomologist.**—*Rep. Dep. Agric. Nyasald* 1934 pp. 16–18. Zomba, 1935.

Information on *Nomadacris septemfasciata*, Serv., in Nyasaland in 1934 is given. During the 1933–34 breeding season the activity of the hoppers was greatly reduced by exceptionally wet weather and severe infestation by the fungus, *Empusa grylli*; the movements of scattered hoppers were negligible, and in most districts some bands failed to reach the adult stage. The continuation of the rains into the dry season caused the resulting swarms, which appeared from February to May, to remain quiescent for considerable periods. The movements of the swarms throughout the year are described. During the pre-breeding flights at the end of the year they were extremely large. The egg-pods laid by these locusts were infested by the larvae of beetles of the genus *Mylabris*, and a Hymenopterous parasite, *Scelio* sp., was reared from eggs found in the Cholo district. Both hoppers and adults were infested to a moderate extent by Dipterous parasites and Nematode worms, while *Empusa grylli* again caused destruction on a large scale. *Citrus* and other fruit trees as well as newly planted maize, cotton and tobacco plants, were severely damaged.

In 1933–34 pure bands of *Locusta migratoria migratorioides*, R. & F., which were not attacked by *Empusa grylli*, occurred only in North Nyasa. Elsewhere this species occurred among bands and swarms of *Nomadacris*.

Faure (J. C.). **The Life History of the Red Locust.**—*Bull. Dep. Agric. S. Afr.* no. 144, 32 pp., 5 pls., 1 map., 14 refs. Pretoria, 1935.

The previous occurrences of *Nomadacris septemfasciata*, Serv., in the Union of South Africa and the present invasion, which began in 1933, are discussed. An account is given of observations on adults and hoppers of *Nomadacris*. Egg-laying, which occurs at night or early morning, takes place in all kinds of soil (provided that they are moist) except limestone. The egg-pods contain 20–100 eggs, and the females oviposit about three times. Incubation lasts about 4 weeks, and the eggs are not killed by gradual desiccation, submergence at 79°F. for 5 days or exposure to temperatures of 50°F. and 32°F. for 5 to 8 days. The duration of the larval stages, the life-cycle and the behaviour of hoppers and adults are discussed. Along the warm and moist east coast of South Africa the swarms wander in all directions,

without undertaking a definite migration to the north [*cf. R.A.E.*, A **22** 46]. All stages feed mainly on graminaceous plants, such as maize, sugar-cane and *Sorghum*, but they also attack such plants as banana, bamboo, palms, tobacco, *Casuarina*, oleander, *Citrus*, *Eucalyptus*, cotton, ground-nuts, tomato and cabbage.

Swarms of *Locusta migratoria migratorioides*, R. & F., appeared in the Union in 1932 and again, mixed with *Nomadacris*, in 1933–34, but it seems probable that the long dry season prevents this species from breeding extensively. The heavy rains of 1933–34 led to the appearance of swarms of *Schistocerca gregaria*, Fsk., and *Locustana pardalina*, Wlk.

The hoppers and adults of *Nomadacris* were infested by the larvae of *Blaesoxipha* sp., which did not readily kill the host, and by Gregarines; the adults were parasitised by Nematodes of the genus *Mermis*, which did not prevent infested females from ovipositing, and by Trombidiid mites. The mortality from *Empusa grylli* did not exceed 10 per cent. About 5 per cent. of the egg-pods were infested by *Stomatorrhina lunata*, F., and the eggs were also attacked by small unidentified mites. *Wohlfahrtia euvittata*, Villen., occurred commonly in *Nomadacris*, *Schistocerca* and *Locustana*.

Coloured plates of different phases of the above four species of locusts are given. The factors influencing coloration are discussed [*cf.* **20** 671] and coloured figures of *Nomadacris* hoppers, reared against black or white backgrounds, are included.

Delassus (—). **French West Africa : Locust Control in Senegal in 1934.**—*Int. Bull. Pl. Prot.* **9** no. 7 pp. M149–M150. Rome, July 1935.

From 1929 to 1933 Senegal had been invaded by locust swarms flying south and south-west from Mauretania and the French Sudan, but in 1934 the majority of the swarms, which consisted mostly of *Locusta migratoria migratorioides*, R. & F., were of local origin, and spread out north-eastwards and eastwards into the neighbouring territories. The use of fluosilicates or arsenical preparations for control is uncertain, for at Casamance the forests are sufficiently dense to prevent the locusts taking the bait laid down for them, and the adults first attack the leaves of palm trees (*Borassus*, *Elaeis*), then the top branches of large trees and then the undergrowth, whereas grass is only attacked when foliage is lacking.

Tomasello (J. F.). **Argentine Republic : Locust Invasion during the Season 1934–1935.**—*Int. Bull. Pl. Prot.* **9** no. 7 pp. M150–M151. Rome, July 1935.

The 1934–35 invasion of *Schistocerca paranensis*, Burm., in Argentina is described. It was less serious than that of 1933–34, which was of exceptional proportions. Huge swarms, extending over 230 and even 300 square miles were seen in the province of Entre Ríos in July and August 1934. Flame-throwers and barriers were used against newly hatched and older hoppers respectively.

Ghosh (C. C.). **India : Insect Pests newly Recorded in Burma.**—*Int. Bull. Pl. Prot.* **9** no. 7 p. M151. Rome, July 1935.

The following insect pests were recorded for the first time from Burma during 1934–35. *Pempheres affinis*, Fst., was found breeding

in the stem of a hybrid variety of cotton, *Oregma lanigera*, Zehnt., was found on sugar-cane leaves in northern Burma, *Byrsocrypta* (*Tetraneura*) *hirsuta*, Baker, occurred on sugar-cane roots, and *Bruchus analis*, F., and *B. phaseoli*, Gyll., were found on pulses.

SCHWARTZ (M.). **Der Kartoffelkäfer.** [The Potato Beetle.]—*Flugbl. biol. Reichsanst.* no. 120 (2nd edn.), 4 pp., 1 col. pl. Berlin, March 1935.

This second edition of a leaflet on *Leptinotarsa decemlineata*, Say [*R.A.E.*, A **20** 539] contains an account of its appearance and eradication in Germany in 1934 [**22** 560].

WATZL (O.). *Meromyza saltatrix*, **L., ein Getreidehalmschädling, ähnlich der gemeinen Weizenhalmfliege.** [*M. saltatrix*, a Pest of the Stems of Cereals similar to the common Wheat-stem Fly.]—*Neuheiten PflSch.* **28** no. 3 pp. 65–67, 3 refs. Vienna, June 1935.

An infestation of wheat by *Meromyza saltatrix* var. *nigriventris*, Macq., and *Chlorops taeniopus*, Mg., was observed in Austria in May 1932. In July *Meromyza* was more numerous than *C. taeniopus*. Pairing was observed on 6th August and all adults were dead by the 20th, whereas individuals of *Chlorops* bred in August survived into September. The two flies injure the stems in a similar manner and it is possible that infestation of the topmost joint of the stem by *Meromyza* may sometimes be attributed to *Chlorops*. The size of larvae found in October and December in cereals that had begun to grow in summer suggested that the eggs had been laid in summer, an indication confirmed by the occurrence of adults in July and August. *Chlorops* oviposited in September or October in autumn-sown winter cereals, its larvae reaching full growth in February and March, but larvae of *Meromyza* were not found in the autumn-sown crops.

SCHÜL (—). **Ameisenschäden an blühenden Stachelbeeren.** [Injury by Ants to blossoming Gooseberries.]—*Ratschläge f. Haus. Garten, Feld* (B) **9** pp. 62–64, 2 figs., 1934. (Abstr. in *Neuheiten PflSch.* **28** no. 3 p. 78. Vienna, June 1935.)

In Germany, ants have been observed to eat away the upper part of gooseberry blossoms, causing them to turn yellow and fall. In some cases 90 per cent. were destroyed. Adhesive bands were applied to tall stems and supporting props, the bushes being kept out of contact with fences, etc., and the twigs of low bushes being kept clear of the ground.

MELIS (A.). **Contributo alla conoscenza morfologica e biologica della *Phytomyza atricornis*, Meig.** [Contribution to the Knowledge of the Morphology and Biology of *P. atricornis*.]—*Redia* **21** pp. 205–262, 19 figs., 3 pls., 15 refs. Florence, 28th May 1935.

For some years the larvae of an Agromyzid, *Phytomyza atricornis*, Mg., of which all stages are described in detail, have caused injury to peas (*Pisum sativum*) in Tuscany. A list of the recorded food-plants of this polyphagous species is given. The author observed three generations between March and June. In Lucca the first adults appeared about 10th March and the females laid eggs in slits in the leaves.

The larvae usually hatched in 2 days and at once began to mine in the parenchyma. After 14–15 days they entered the pupal period, which lasted 12–14 days. Captive females lived for about 3 weeks and laid about 40 eggs. The females fed mostly on the juices in the lesions made by their ovipositors, while the males fed mostly on sugary substances. In severe infestation the injury to the foliage destroys the plants, especially the young ones. The parasites mentioned in the literature are noted [*cf. R.A.E.*, A **16** 474]. At Florence, from the larvae of *Phytomyza*, the author obtained *Entedon* sp., of which the male and female, mature larva and pupa are described, *Pleurotropis* sp., of which the male and female are described, *Achrysocharis* sp., and *Dacnusa areolaris*, Nees. The larvae of *D. areolaris* were ectophagous, while those of *Entedon* were ectophagous for a couple of days and then became endophagous for a similar period, after which they fed on the leaf-juice inside the mine of the host. The larvae of *Pleurotropis* and *Achrysocharis* were endophagous. A species of *Thrips* preyed on both larvae and adults. As these natural enemies become effective only after the injury has occurred, artificial measures were tried. In addition to the collection of infested leaves, a spray of nicotine sulphate and soft soap (1 : 10 : 1,000) is recommended.

Reichert (A.). **Rosenschädlinge.** [Rose Pests.]—*Kranke Pflanze* **12** no. 6 pp. 98–99, 1 pl. Dresden, June 1935.

Popular notes are given on the bionomics of the Trypetid, *Rhagoletis* (*Zonosema*) *alternata*, Fall., and of the Torymid, *Megastigmus* sp., both of which injure the seeds of roses in Germany.

Fulmek (L.) & Ripper (W.). **Nützlinge in Garten, Feld und Wald.** [Natural Enemies of Pests in Garden, Field and Forest.]—La. Cr. 8vo, 128 pp., 48 figs. Stuttgart, Franckh'sche Verlagshandl., 1935. Price *M*.6.

This is an introductory guide to biological control, with particular reference to Austria and Germany. Examples are given of insectivorous mammals, birds, frogs, lizards and insects, with brief notes on fungi, bacteria, and Nematodes and other worms. Chapters on the utilisation of natural enemies, dealing mainly with the fostering of indigenous species, are followed by a subject index.

Andrewartha (H. G.). **The Prediction and Control of Outbreaks of *Thrips imaginis*, Bagnall.**—*J. Aust. Inst. agric. Sci.* **1** no. 2 pp. 78–80, 2 refs. Sydney, June 1935.

The factors limiting the abundance of *Thrips imaginis*, Bagn., in Australia [*cf. R.A.E.*, A **23** 148, etc.] are humidity and food in summer and autumn, temperature and food in winter, and finally temperature in spring. Under laboratory conditions reproduction did not take place unless pollen was included in the diet. It is mainly the pupal stage that is influenced by humidity. Soils containing less than 25 or more than 90 per cent. of their field capacities [*cf.* **23** 149] are fatal to most of the pupae. Temperature influences the length of adult life and the rates of development and of egg production. Between 9 and 25°C. [48·2–77°F.] the metabolic processes are accelerated in proportion to the rise in temperature. Below 9°C. they are almost at a standstill

and above 25°C. the rate of increase is no longer proportionate to the rise in temperature [*cf.* **22** 61].

Red ochre, although it has no insecticidal or repellent action, is useful as a mechanical barrier, especially when weather conditions make it necessary to protect unopened buds. Dusting with derris or pyrethrum [*cf.* **22** 449], with talc or kaolin as the carrier, gives a fairly satisfactory, but in very severe infestations, not a certain control.

STEELE (H. V.). **Thrips Investigation : Some common Thysanoptera in Australia.**—*Pamphl. sci. industr. Res. Aust.* no. 54, 59 pp., 32 figs., 60 refs. Melbourne, April 1935.

This paper deals with 15 species of thrips found in Australia, of which most occur in flowers and some are known pests of crops. A list of the species is followed by a key based on morphological characters. Each species is then dealt with separately, with detailed descriptions of both sexes and notes on the immature stages and bionomics. Most of the information of economic importance on the chief species has already been noticed [*cf. R.A.E.*, A **21** 105, 408; **22** 22, 60, etc.]. The thrips recorded from tobacco in New South Wales as *Anaphothrips obscurus*, Müll. [**22** 623], is here called *Anaphothrips* (*Hemianaphothrips*) *concinnus*, Morison, and the author thinks that the important vector of spotted wilt of tomato in South Australia [*cf.* **18** 666, etc.], is not *Frankliniella insularis*, Morison, but a related species of the same genus. *Taeniothrips simplex*, Morison, of which *T. gladioli*, Mlt. & Stnw., is considered a synonym, has damaged gladiolus near Melbourne and Adelaide since 1932 and in the former place (although no thrips were found in the gladiolus fields through the winter) injured the stored corms. *Heliothrips haemorrhoidalis*, Bch., which reproduces parthenogenetically, is a pest of greenhouses in South Australia, and near Melbourne attacks rhododendrons all the year round.

COTTIER (W.). **Aphides affecting cultivated Plants. The Aphides of the Potato.**—*N.Z.J. Agric.* **50** no. 5 pp. 281–288, 2 figs., 6 refs. Wellington, N.Z., 20th May 1935.

Brief notes are given on the bionomics and food-plants of *Myzus persicae*, Sulz., *Macrosiphum* (*Myzus*) *solani*, Kalt. (*pseudosolani*, Theo.) and *M. solanifolii*, Ashm. (*gei*, auct.), which are common on the leaves of potato in New Zealand [*cf. R.A.E.*, A **20** 324], and the winged and wingless forms of each species are described. Since *M. persicae* is a known vector of virus diseases, particularly leaf-roll of potato [*cf.* **20** 212], and since infestation by it early in the season is the most important factor in the spread of the disease, potato fields should be isolated from cruciferous crops that act as shelters and food-plants for *M. persicae* in winter and as reservoirs of potential infestation. A spray of nicotine sulphate (1 : 800) and soap (2–3 lb. per 100 gals. spray) is recommended where spraying is economically warranted.

MORGAN (W. L.). **Derris Root Powder. Its Place in Cabbage Moth Control.**—*Agric. Gaz. N.S.W.* **46** pt. 5 pp. 267–268, 1 fig. Sydney, May 1935.

In experiments in New South Wales on the control of *Plutella maculipennis*, Curt., on cabbage finely powdered derris root mixed with talc

(1 : 9) was about as effective as lead arsenate mixed part for part with hydrated lime or kaolin. Not more than 10 days should elapse between treatments with either derris or lead arsenate. As lead arsenate dusts are cheaper, they should be used until the hearts begin to form, but after that derris dusts should take their place.

Insect Pests and their Control.—*Agric. Gaz. N.S.W.* **46** pt. 5 pp. 271–275, 7 figs. Sydney, May 1935.

These notes, which belong to a series on insect pests in New South Wales [*cf. R.A.E.*, A **23** 421], include brief accounts of the bionomics of *Sitodrepa panicea*, L., and *Lasioderma serricorne*, F., which infest foodstuffs. They may be controlled by fumigating with carbon bisulphide.

Tooke (F. G. G.). **The Eucalyptus Snout Beetle.**—*Fmg in S. Afr.* 1935, reprint no. 31, 1 p. Pretoria, April 1935.

Anaphoidea nitens, Gir., the introduced parasite of *Gonipterus scutellatus*, Gir. [*cf. R.A.E.*, A **20** 296, etc.], which attacks *Eucalyptus* spp. in South Africa, has proved successful except in the high veldt where the climatic conditions are unfavourable to the parasite and the physical properties of the soil sometimes retard its development. A list of many species of *Eucalyptus* shows the extent to which the various species are susceptible to attack by this weevil.

Yagi (N.). **On the Nocturnal Activity of the Moth of *Chilo simplex*, Butler.** [*In Japanese*]—*J. Agric. Exp. Sta. Tokyo* **2** no. 4 pp. 481–490, 4 pls., 2 figs., 3 refs. Tokyo, March 1935. (With a Summary in English.)

The author has devised a self-registering apparatus, which is here illustrated, for studying the nocturnal activity of insects. Adults of *Chilo simplex*, Butl., placed in the open air in this apparatus were found to become active for a short time about an hour after sunset and then to be quiescent for an hour or two, after which they were active again until towards midnight. Two very short periods of activity, separated by only a brief interval, were also registered towards dawn. These data were supplemented by observations on the behaviour of the moths under artificial changes from light to darkness and darkness to light. The author concludes that the moth is stimulated to activity in the first place by changes in the intensity of light and, in the second place, by the accommodation of the pigment granules in the retinal cell of the compound eyes to the changed intensity of the light [*cf. R.A.E.*, A **23** 69].

Nguyên-công-Tiêu. **Une invasion de punaises du letchi au Tonkin (*Tessaratoma papillosa*, Dru.).**—*Bull. econ. Indochine.* **38** pp. 89–90, 1 pl. Hanoi, 1935.

From August to September 1933, plantations of litchee (*Nephelium litchi*) at Ha-dong and Tonkin were badly damaged by *Tessaratoma papillosa*, Dru. The eggs are laid in groups of 10–20 on the lower surfaces of the leaves. The adults secrete a liquid that burns the leaves on which they feed and defends them against predators. The attack occurred some time after the harvest of the fruit. As the Pentatomid

does not fly well, large numbers can easily be caught in nets. Various insecticides were tried without success, since the leaves are coated with wax, but the fungi, *Penicillium* sp. and *Spicaria globulifera*, have been found to attack a sufficient number of the adults to reduce infestation considerably.

AWIBOWO (R.). **De klapperbladkever** *Brontispa froggatti* **var.** *selebensis* **en zijn biologische bestrijding op Celebes. (Voorloopige mededeeling.)** [The Coconut Leaf Beetle, *B. froggatti* var. *selebensis*, and its biological Control in Celebes. (Preliminary Communication.)] —*Landbouw* **10** no. 2 pp. 76–92, 9 figs. Buitenzorg, August 1934. (With a Summary in English.)

In the eastern parts of the Netherlands Indies the larvae and adults of *Brontispa froggatti* var. *selebensis*, Gestro, feed on the unopened leaves of coconut, apparently its only food-plant. The adult, egg, larva and pupa are briefly described. The eggs are laid on the leaves where feeding occurs and hatch in about 4 days. The larval stage, with four moults, takes about 32 days, and the pupal 5–6.

Tobacco-soap, kerosene emulsion and lead arsenate were tested with varying success, but neither these measures nor cutting out the infested shoot were willingly adopted by native growers in Celebes.

In South Celebes, only one parasite, the Trichogrammatid, *Haeckeliana brontispae*, Ferrière, which attacked the eggs, was bred from *B.f. selebensis*. As *B. longissima*, Gestro, a Hispid with a similar life history, rarely causes injury in Java, a search was made there for its parasites and for those of a related Hispid, *Plesispa reichei*, Chap. The following parasites of *B. longissima* were found, the figure in brackets representing the percentage of parasitism : Two egg-parasites, *H. brontispae* (17) and *Ooencyrtus* sp. (10); and a parasite, *Tetrastichodes brontispae*, Ferrière, of the larvae (10) and pupae (60–90). The parasites of *P. reichei* were an egg-parasite, *Ooencyrtus* sp. (23); a larval parasite, *Pleurotropis detrimentosus*, Gah. (15); and a parasite, *Tetrastichodes plesispae*, Ferrière, of both larvae (10) and pupae (60–90). No hyperparasites or parasitic fungi were found in Java.

Pupae of the Eulophid, *T. brontispae*, in host pupae were imported into South Celebes in May 1932. In March 1933 it was recovered in several places, and parasitism was sometimes as high as 90 per cent. Further importations of parasitised pupae were made in 1933, and in 1934 it was reported that infestation by *B. f. selebensis* had become less.

HUCKETT (H. C.). **Planting Dates as an Aid to Potato Insect Control on Long Island.**—*Bull. N.Y. agric. Exp. Sta.* no. 652, 27 pp. 3 diagrs., 5 refs. Geneva, N.Y., March 1935.

Details are given of a series of experiments on Long Island during 1928–34 to ascertain the relation between the date of planting potatoes and the yield of tubers, with special reference to its effect on local spraying practices for the control of insect pests [*cf. R.A.E.*, A **19** 474]. One late and one quick maturing variety of potato were used in these experiments. Bordeaux mixture (4–6–50) served as a basis for all sprays, which were applied in June and July, and to which calcium arsenate was added at the rate of 6 lb. to 100 U.S. gallons for the control of the Colorado potato beetle [*Leptinotarsa decemlineata*, Say] and *Epitrix cucumeris*, Harr. Other pests were *Macrosiphum solanifolii*,

Ashm., *Myzus persicae*, Sulz., and *Emposasca fabae*, Harr. The tabulated results show that when the late maturing variety was planted early (25th March to mid-April) the yield was invariably larger and better than when it was planted after mid-April, provided that the foliage was sprayed throughout June against *Leptinotarsa*. Usually, spraying contributed to the results, but did not eliminate the necessity for earlier planting. In the case of the quicker maturing variety, the results were similar, but the effect of earlier planting and spraying were not so marked. Planting should be completed within 2–3 weeks of the beginning of the growing season, as early planting lessens the effect of injury by the Aphids, leafhoppers and flea-beetles at midsummer.

Cyprus. Memorandum on Legislative Position in Regard to Plant Imports. Position as at 31st December 1934. 1 p. Nicosia, Cyprus, 1935.

Articles allowed to enter Cyprus and articles conditionally prohibited under the *Phylloxera* Prevention Law No. 22 of 1890 and the Diseases of Plants Prevention Law, No. 6 of 1893, and various Orders concerning the importation of plants made under them are enumerated. The import of potatoes from any country is forbidden, except that limited quantities may be introduced for seed purposes under special permission and accompanied by a certificate declaring that the area of origin is free from *Phthorimaea operculella*, Zell., *Leptinotarsa decemlineata*, Say, and the fungus, *Synchitrium endobiotium*.

List of Insect Pests, Fungus and other Diseases prohibited Entrance into Egypt.—*Leafl. Crop. Prot. Sect. Min. Agric. Egypt* no. 26 4 pp. typescript. Cairo, 1935.

A classified list of the plants that are prohibited from entering Egypt is given together with the insects, fungi and diseases against which the prohibition is directed.

Yugo-Slavia. Countries Infected with Potato Disease. Order No. 174.—2 pp. typescript. Official Gazette no. 13308/11. Belgrade, 22nd March 1935.

The following countries are considered by the Jugoslavian Authorities to be infested with insect pests of potatoes : with *Leptinotarsa decemlineata*, Say, Great Britain, Canada, the United States of America, France and Germany ; and with *Phthorimaea operculcila*, Zell., Spain, Portugal, France, Italy (Sicily), Malta, Azores, the whole of America with the Antilles, Morocco, Algiers, Tunis, Canary Islands, Madeira, Belgian Congo, the Union of South Africa, Rhodesia, Mauritius, Cyprus, British India, Sumatra, Java, the whole of Australia, Tasmania and New Zealand. Countries held to be infested with *Aspidiotus perniciosus*, Comst., are Austria, Hungary, Rumania, Spain, Portugal, southern France, Italy, the United States of America, Canada, Mexico, Chile, Argentina, Brazil, Uruguay, the Union of South Africa, Algiers, Mesopotamia (Iraq), British India, China, Japan with Korea, Australia, Tasmania and New Zealand.

According to the Official Gazette of 9th July 1935 France and Italy are not to be included among the countries infested with *A. perniciosus*.

Brazil. Measures supplementary to the Regulations for the Protection of Plant Health, Decree no. 24,114.—6 pp. typescript. Rio de Janeiro, 1935.

Among a number of measures supplementary to Decree no. 24,114 of 12th April 1934, prohibiting the import, export and internal transport of various plants and parts of plants, the import of potatoes is prohibited unless accompanied by a certificate declaring that the district from which they originate is free from *Phthorimaea operculella*, Zell., and *Leptinotarsa decemlineata*, Say. The import of maize unless accompanied by a certificate declaring it to be the product of a region free from *Pyrausta nubilalis*, Hb., is similarly prohibited.

Decree no. 1232 of the People's Commissariat for Agriculture of 28th February 1935. Restriction of Imports into the U.S.S.R. of Seeds and Planting Material, Plants and agricultural Products.—3 pp. typescript. Moscow, 1935.

In view of the prevalence in other countries of the potato moth [*Phthorimaea operculella*, Zell.] and the Colorado potato beetle [*Leptinotarsa decemlineata*, Say], and diseases subject to quarantine regulations, the import into the U.S.S.R. of potatoes for consumption or for seed, bulbs, tubers or vegetables is prohibited. Samples not exceeding 5 kg. net weight may be imported for the purposes of scientific research by the Institute for Plant Cultivation, if they are accompanied by a certificate stating that they are free from infection, and if they are imported through certain specified ports and originate from countries where plant quarantine or protection measures are in force. The import of melons and watermelons into the Turkmen Soviet Socialist Republic and the Stalingrad District from Persia and countries infested by the melon fly [*Myiopardalis pardalina*, Big.] is prohibited.

Hoggan (I. A.) & Johnson (J.). **A Virus of Crucifers and other Hosts.**—*Phytopathology* **25** no. 6 pp. 640–644, 2 figs., 5 refs. Philadelphia, Pa, June 1935.

A description is given of a mosaic of cruciferous plants in the United States. The virus can be transferred mechanically by means of plant-extracts but is more readily transmitted by the Aphids, *Myzus persicae*, Sulz., and *Brevicoryne brassicae*, L. Experiments showed that tobacco could be infected by rubbing with virus extracts from cabbage and horse-radish, and it is considered possible that Aphids might carry the virus to tobacco grown near cruciferous crops.

Reddick (D.). **A Potato Disease.**—*Phytopathology* **23** no. 7 pp. 622–624, 4 refs. Lancaster, Pa, July 1933.

Reddick (D.). **Mites on Potatoes.**—*Op. cit.* **25** no. 6 p. 654, 1 ref. June 1935.

In the first paper a mite, *Tarsonemus* sp., is mentioned as causing a disease of potato, which resulted in the withering of the leaves in New York State in 1932. In the second paper the mite in question is stated to be *T. latus*, Banks, but it is no longer believed to have caused the disease.

Hüsing (J. O.). **Ueber einen neuen Parasiten** *Lariophagus distinguendus* **Först. (Hym. Chalc.) an** *Ptinus fur* **L. (Col. Ptin.).** [On a new Parasite of *P. fur*, *L. distinguendus*.]—*Zool. Anz.* **110** no. 11–12 pp. 324–326, 2 refs. Leipzig, 15th June 1935.

The Chalcid, *Lariophagus distinguendus*, Först., was obtained by the author from a comb of *Vespa crabro*, L., which showed traces of attack by *Ptinus fur*, L. Observations since the summer of 1934 showed that the parasite lays its egg either in or on the host larva and pupates in its cocoon.

Muesebeck (C. F. W.). **Three new reared parasitic Hymenoptera, with some Notes on Synonymy.**—*J. Wash. Acad. Sci.* **25** no. 6, pp. 279–283, 1 ref. Washington, D.C., 15th June 1935.

The new species described are the Scelionid, *Telenomus catalpae*, from Maryland from eggs of *Ceratomia catalpae*, Boisd., and the Braconids, *Apanteles epiblemae* from Kansas from *Epiblema strenuana*, Wlk., and *A. thujae* from Maine from *Recurvaria thujaella*, Kf. The author now considers *Macrocentrus laspeyresiae*, Mues. [*cf. R.A.E.*, A **20** 596] a synonym of *M. instabilis*, Mues. [*loc. cit.*], and Brues' genus *Aneurobracon* is stated to be synonymous with *Mesocoelus*, Schulz.

Drake (C. J.) & Poor (M. E.). **An undescribed Rubber Tingitid from Brazil (Hemiptera).**—*J. Wash. Acad. Sci.* **25** no. 6 pp. 283–284, 1 fig. Washington, D.C., 15th June 1935.

A description is given of a new lace-bug, *Leptopharsa heveae*, sp. n., taken in large numbers on leaves of rubber in Brazil. This is the first record of a Tingid pest of rubber.

Nelson (R. M.). **Effect of Bluestain Fungi on Southern Pines attacked by Bark Beetles.**—*Phytopath. Z.* **7** no. 4 pp. 327–353, 5 figs., 10 refs. Berlin, 1934.

The results of an investigation in North Carolina on the relation between bark-beetles and the blue-stain fungi invariably found in *Pinus echinata*, *P. rigida* and *P. virginiana* infested by them show that the Scolytids are probably direct carriers. The beetles concerned are species of *Dendroctonus*. *D. frontalis*, Zimm., with which *Ceratostomella pini* is associated [*cf. R.A.E.*, A **20** 172, etc.], is the most important. Species of *Ips* are commonly associated with *Dendroctonus*. In certain conditions they may become sufficiently numerous to attack healthy pines, but as a rule they only attack weakened trees. Blue-stain in living trees not attacked by bark-beetles is extremely rare. It appears near the galleries within a week after the tree is attacked. Although the beetles alone might eventually kill the tree, pines attacked both by the beetles and the fungus usually die within 3 or 4 weeks. The fungus is probably indispensable to the beetle, as it reduces the water content of infested trees to the degree suitable for the development of the broods.

Atanasoff (D.). **Old and new Virus Diseases of Trees and Shrubs.**—*Phytopath. Z.* **8** no. 2 pp. 197–223, 17 figs., 76 refs. Berlin, 1935.

The literature on virus diseases of trees and shrubs is briefly reviewed, and descriptions are given of several new virus diseases noted by the

author in Bulgaria in 1933–34. *Aphis spiraeae*, Schout., transmits witches' broom of *Holodiscus discolor* from diseased plants to healthy ones in Washington and Oregon. Disease-mottled leaves of *Citrus* in Sicily are attacked by *Toxoptera aurantii*, Boy. Mosaic of elder (*Sambucus nigra*) is spread in Czechoslovakia and Germany by *Aphis sambuci*, L.

Atanasoff (D.). **Mosaic of Stone Fruits.**—*Phytopath. Z.* **8** no. 3 pp. 259–284, 26 figs., 30 refs. Berlin, 1935.

This paper includes a section on the possible insect carriers of the mosaic of stone fruit trees in Bulgaria. Experiments were carried out in 1932 and again in 1933 to discover if the scale insect, *Lecanium corni*, Bch., which was suspected to be the vector of plum mosaic in western Bulgaria and Jugoslavia, was in fact the carrier. The results were negative, but further investigations are to be made. Transferring *Anuraphis padi*, L., from infected plum trees to healthy ones showed this Aphid to be a vector of mosaic disease of plum in western Bulgaria. Of the fruit trees tested, apricot was the least susceptible. In southern Bulgaria most of the limited number of imported plum trees in two State nurseries showed mosaic symptoms, while none of the much more common Kustendil plums was diseased, although this native plum had been the most susceptible of the varieties of trees used in the test with the Aphid. The absence of the mosaic was due to the lack of a suitable insect vector in southern Bulgaria, which has a very different climate from that of western Bulgaria. Winter spraying with oil emulsions or tar distillate, supplemented by summer sprays of nicotine, is recommended.

[Yankovskiĭ (I. V.).] **Янковский (И. В.). Materiale zur Kenntnis der Bockkäfer Mittelasiens.** [Material for a Knowledge of the Longicorns of Central Asia.] [*In Russian.*]—*Bull. Univ. Asie cent.* **19** pp. 95–115. Tashkent, 1934. (With a Summary in German.) [Recd. June 1935.]

This account of the Longicorn beetles of Central Asia includes a description of the new species *Dokhtouroffia baeckmanni* which, with its aberration *retardata*, mines in spruce and should be numbered among the important forest pests. Several new aberrations of *Semanotus semenovi*, Okun., which mines in juniper, are also described.

Graber (L. F.) & Sprague (V. G.). **Cutting Treatments of Alfalfa in Relation to Infestations of Leafhoppers.**—*Ecology* **16** no. 1 pp. 48–59, 1 fig., 21 refs. Brooklyn, N.Y., January 1935.

Since in Wisconsin, where lucerne is rarely cut more than twice a year, the losses directly ascribed to the leafhopper, *Empoasca fabae*, Harr., occur principally in the second growth and deferred cutting of the first growth has long been recommended to prevent stunting and yellowing of the second crop, an experiment was carried out in the summers of 1932 and 1933 to ascertain the relation of the time of cutting the first crop to populations of leafhoppers. It was found that in plots where the first growth was cut 12 days earlier than in the control plots, the number of nymphs in the second growth increased twenty-eight times. Deferred cutting of the first crop apparently provided for a

more abundant and complete deposition of eggs in this growth, so that the eggs, or the nymphs hatching from them, were destroyed in the preparation of the hay. A marked decrease in the numbers of surviving and migrating adults during the end of June and beginning of July would point to a decrease in egg-laying during this period, when deferred cutting normally takes place in Wisconsin.

TOYOTA (T.), OKAZAKI (K.) & NAKANO (K.). **Studies on a Fruit-fly injurious to Cherry.** [*In Japanese.*]—107 pp., 7 pls. Yamagata Prefecture, Japan, February 1935.

An undetermined Trypetid is very injurious to cherry in Yamagata Prefecture in the northern part of Honshu, and a similar species is also known to occur in Hokkaido. Descriptions are given of all stages. The fly is not found in other fruits and has one generation a year. It overwinters in the pupal stage, and the adults emerge in May, when the trees blossom. They live some 17 or 18 days. The females lay over 100 eggs, mostly in the upper parts of the fruits, presumably 10–14 days after emergence. Usually one egg is deposited in each fruit. The eggs hatch in 3–6 days. The larvae mature in 7–16 days, passing through 3 instars, and pupate in the soil. The pupal stage lasts 10 or 11 months. The fruits on the lower parts of the trees are preferred. A Braconid sometimes parasitises 25 per cent. of the larvae.

SHIBUYA (S.) & YAMADA (S.). **Life History of** *Lasioderma serricorne*, **Fab., injuring dried Gingers (Preliminary Report).** [*In Japanese.*] —*Oyo-Dobuts. Zasshi* **7** no. 3 pp. 104–106. Tokyo, June 1935.

The larvae of *Lasioderma serricorne*, F., bore into stored dried ginger and cause serious damage. The females lay about 20 eggs each, usually in the crevices of the ginger but sometimes in the tender tissues. The eggs hatch in 5–10 days. In summer the larval stage occupies 60–70 days. The pupal stage lasts 3–6 days in summer and 6–9 in spring. There are usually two generations a year in Japan, but sometimes there is only one. The larvae overwinter and the adults emerge in late May and early June, and again in August and early September.

SHINJI (O.). **On a Species of Non-Diaspine Coccidae, for which a new Subfamily is to be erected.** [*In Japanese.*]—*Oyo-Dobuts. Zasshi* **7** no. 3 pp. 106–108, 1 fig., Tokyo, June 1935.

Serrolecanium bambusae, gen. et sp. n., is described from the adult female,* and a new subfamily SERROLECANIINAE is proposed for it.

KUWAYAMA (S.). **Periods of Outbreaks of** *Pyrrhia umbra* **Hufn. and Effectiveness of Autumn Ploughing for its Control.** [*In Japanese.*] —*Oyo-Dobuts. Zasshi* **7** no. 3 pp. 101–111. Tokyo, June 1935.

Pyrrhia umbra, Hfn., which is very injurious to soy beans in Hokkaido, has one generation a year and hibernates in the pupal stage in shallow soil. The moths, which are only slightly phototropic, emerge from late June to the end of July and sometimes live for 20 days. They are readily attracted by molasses. Each female lays over 400

* We are informed by Dr. R. Takahashi that this species has already been described by Kuwana as *Antonina tobai*.—ED.

eggs singly on the lower sides of the upper leaves. The eggs hatch in 4–7 days. The larvae, which mature in 24–28 days, feed at first on the young leaves and afterwards on the pods and beans. Outbreaks take place at intervals of 6 years, and every other outbreak seems to be particularly severe. More than half the larvae were killed by autumn ploughing, which, however, has comparatively little effect on the larval parasites, *Paniscus ocellaris*, Thoms., and *Ophion luteus*, L.

Ishii (T.). **On the Percentage of Parasitism of the Egg Parasite of the Rice Borer** (*Trichogramma japonicum* **Ashm.) in the Nursery-fields of Rice.** [*In Japanese.*]—*Oyo-Dobuts. Zasshi* **7** no. 3 pp. 119–120. Tokyo, June 1935.

Near Tokyo in 1934, the adults of *Chilo simplex*, Butl., emerged from the beginning of June to the middle of July. *Trichogramma japonicum*, Ashm., parasitised 8·3 per cent. of the egg masses and 2·7 per cent. of the eggs in the beginning of June, but by the end of July these percentages had increased to 76·5 and 48·6. Variations in the percentage of parasitism from year to year may be due to the number of the overwintering parasites and the effect of temperature on the life-cycle of the parasite. When the temperature gradually increases from 22°C. [71·6°F.], the percentage of parasitism tends to increase with it.

Insect Pests of the Vine. [*In Japanese.*]—*Byo-Giachu Shiryo* no. 8 pp. 1–18, 8 figs. Fukuoka agric. Exp. Sta., Buzen Branch, May 1935.

In Fukuoka Prefecture over 60 insects are now known to occur on grape vines, of which the more important are briefly treated here. They include *Phylloxera vitifolii*, Fitch (*vastatrix*, Planch.), *Paranthrene regalis*, Butl., *Erythroneura apicalis*, Nawa, *Acrothinium gaschkevitchi*, Motsch., *Xylotrechus pyrrhoderus*, Bates, and *Stenoptilia vitis*, Sasaki. Brief descriptions and short notes on their bionomics and control are given. A calendar for spraying is appended.

Kato (S.). **On** *Centeter cinerea*, **Aldrich exported to New Zealand.** [*In Japanese.*]—*Kontyû* **9** no. 1 pp. 7–24, 7 figs., 16 refs. Tokyo, May 1935.

In October 1934, 4,800 pupae of *Centeter cinerea*, Aldr., which parasitises *Popillia japonica*, Newm., in Japan [*cf. R.A.E.*, A **22** 73], were exported to New Zealand by the Hokkaido Agricultural Experiment Station for the control of the grass grub, *Odontria zealandica*, White. The adult fly is described. In Japan in the summer of 1920, the fly attacked 40·5 per cent. of *Popillia*, and 44·7 per cent. of the parasitised beetles contained two or more parasites. *Phygadeuon akaashii*, Uchida, the adult of which is described, is a parasite of the pupae of this fly.

Misumi (T.). **Results of Studies on** *Donacia aeraria*, **Baly.** [*In Japanese.*]—*Res. Bull. Fukui agric. Exp. Sta.* no. 20 pp. 1–45, 6 pls. Fukui, Japan, March 1935.

Donacia aeraria, Baly, causes serious damage in May and June in rice-fields, especially in those near mountains in Fukui Prefecture.

All stages are described. There is one brood a year. The larvae hibernate below the surface in damp soil. They begin to attack the roots of rice from the end of May. Sometimes over 50 larvae are found in a rice stump. Early-planted rice is most injured. They also feed on various grasses and other plants such as *Potamogeton*. The adults feed on aquatic plants, including *Potamogeton*. They live for about 13 days. The eggs are deposited on the lower sides of leaves of aquatic plants, especially on those in deep water, and on the average a female lays about 70 eggs, usually in 5 masses. Incubation lasts about 9 days, and pupation takes place in late June. Draining the fields during the winter and removing the auxiliary food-plants are recommended.

YAMAMOTO (T.). **On the Biology of** *Dictyoploca japonica*. [*In Japanese.*]—*Oyo-Dobuts. Zasshi* **7** no. 4 pp. 200–203. Tokyo, July 1935.

The eggs of a wild silkworm, *Dictyoploca japonica*, Moore [*cf. R.A.E.*, A **6** 502], are laid in groups on the stems of chestnut, 3–10 feet above the ground. They hatch in early May. Walnut and *Ginkgo* are known to be fed upon by the larvae, but the young larvae died when fed on them in captivity. The larvae begin to spin cocoons in late June and early July, and pupate within 5–8 days.

LINNANIEMI (W. M.). **Kertomus tuhoeläinten esiintymisestä suomessa vuosina 1917–1923**. [Report on the Occurrence of Plant Pests in Finland in 1917–1923.]—*Valt. Maatalousk. Julk.* no. 68, 159 pp., 1 map. Helsinki, 1935. (With a Summary in German.)

In this report the pests are arranged according to the class of food-plant they attack.

The more important pests of cereals were *Oscinella* (*Oscinus*) *frit*, L., which in some places destroyed as much as half the barley crop, the barley mining fly, *Hydrellia griseola*, Fall., which attacked barley, oats and winter wheat, *Deltocephalus striatus*, L., injuring wheat, rye, oats and barley, and *Mayetiola destructor*, Say, on rye, barley and wheat. The principal Elaterid was *Corymbites cupreus* subsp. *aeruginosus*, F.

On fodder grasses the chief pest was *Charaeas graminis*, L. Aleurodids, *Amaurosoma* spp., mites and *Aptinothrips rufus*, Gmel., reduced the grass-seed crop. Clover was attacked by *Dasychira selenitica*, Esp., *Apion apricans*, Hbst., and *Haplothrips niger*, Osb.

The chief pests of field and garden peas were *Sitona* spp. *Cydia* (*Grapholitha*) *nigricana*, Steph., and *Phytometra* (*Plusia*) *gamma*, L., occasionally caused considerable damage. Sugar beet and red beet suffered increasing injury from *Pegomyia hyoscyami*, Panz. Other pests of beet included *Blitophaga opaca*, L., *Chaetocnema concinna*, Marsh., and *Cassida nebulosa*, L. Carrots were attacked by *Psila rosae*, F., while potatoes were injured to some extent by Elaterids. Cabbage pests included *Phyllotreta undulata*, Kutsch., and other Halticids, *Phaedon cochleariae*, F., *Blitophaga opaca*, *Ceuthorrhynchus quadridens*, Panz., *Phorbia* (*Chortophila*) *brassicae*, Bch., *Pieris brassicae*, L., *Plutella maculipennis*, Curt., *Barathra* (*Mamestra*) *brassicae*, L., *Eurydema oleraceum*, L., *Dolycoris baccarum*, L., and *Lygus* sp. In 1919 *Cicadella* (*Tettigoniella*) *viridis*, L., in association with *P. maculipennis* infested cabbage at Liperi. Cruciferous seed crops were badly damaged by *Meligethes aeneus*, F., which in one instance destroyed 90 per cent. of the turnip seed crop. Of other vegetable crops onions

were injured most. The chief pests were *Hylemyia antiqua*, Mg., and *Eumerus strigatus*, Fall. Spinach was injured by *Pegomyia hyoscyami*.

Textile plants remained almost unharmed. Flax was infested by *Phytometra gamma*, but the economic loss was probably slight. In some localities the leaves of hops were badly injured by *Hypena rostralis*, L.

Fruit trees suffered comparatively little. The most important pests were *Aphis* (*Doralis*) *pomi*, DeG., *Hyponomeuta padellus malinellus*, Zell., *Argyresthia conjugella*, Zell., *Cydia* (*Carpocapsa*) *pomonella*, L., and *Xyleborus dispar*, F., on apple., *Chematobia brumata*, L., and Tetranychid mites on apple and other fruit trees, *Hyalopterus arundinis*, F., *Caliroa* (*Eriocampoides*) *limacina*, Retz., and *Eriophyes similis*, Nal., on stone-fruits, and *E. piri*, Pgst., on pear.

Pteronus ribesii, Scop., and *Pristiphora pallipes*, Lep., were the most common pests of gooseberry. *Incurvaria capitella*, Cl., became increasingly harmful to currants. Currants and, more rarely, gooseberries were attacked by Aphids, including *Capitophorus* (*Cryptomyzus*) *ribis*, L., *Amphorophora cosmopolitana*, Mason (*Rhopalosiphoninus lactucae*, Kalt.) and *Aphis* (*Doralis*) *grossulariae*, Kalt. Among other pests of bush-fruits were the gooseberry moth, *Zophodia convolutella*, Hb., *Pachynematus pumilio*, Knw., and *Lecanium corni*, Bch. *Anthonomus rubi*, Hbst., attacked raspberry and strawberry. The larvae of *Phorbia* (*Chortophila*) *dentiens*, Pand., a new pest, injured the shoots of raspberry.

Few reports were received of injury to deciduous and coniferous trees. Of the former, alder, which was infested by *Melasoma aenea*, L., and *Larentia autumnalis*, Ström., seems to have suffered most. *Cheimatobia brumata* infested oak and lime. In some localities conifers were severely injured by insects, including *Chermes* (*Dreyfusia*) sp. on *Abies sibirica* and *Chermes* (*Pineus*) *pini*, L., on mountain pine. Other pests included *Diprion* (*Lophyrus*) sp. and *Melolontha hippocastani*, F.

Ornamental plants were attacked, but not as a rule badly damaged, by various pests, of which *Gracilaria* (*Xanthospilapteryx*) *syringella*, F., infesting the foliage of lilac, was the most common. Roses were injured by *Monardis* (*Ardis*) *plana*, Kl., *Tortrix bergmaniana*, L., *Anthonomus rubi* and *Macrosiphum rosae*, L.

Hukkinen (Y.) & Vappula (N. A.). **Kertomus tuhoeläinten esiintymisestä suomessa vuosina 1924 ja 1925.** [Report on the Occurrence of Pests in Finland in 1924 and 1925.]—*Valt. Maatalousk. Julk.* no. 69, 107 pp., 5 maps. Helsinki, 1935. (With a Summary in German.)

Many of the pests recorded here were mentioned in the previous report [see preceding abstract]. In 1924 *Chlorops taeniopus*, Mg. (*pumilionis*, Bjerk.) did serious injury to barley. Peas imported from Holland were found to be infested by *Bruchus pisorum*, L., and were therefore sent back. Turnip leaves were very severely injured by *Scaptomyza* sp. in one locality, and in some cases cabbage seedlings were destroyed by *Tipula* sp. Beets and cucumber seedlings were attacked by *Trogophloeus pusillus*, Grav. Apple was chiefly injured by *Aphis* (*Doralis*) *pomi*, DeG. *Argyresthia cornella*, F., not previously recorded as a pest in Finland, occurred in one apple orchard. Gooseberry was attacked by *Bryobia praetiosa*, Koch, which appeared to be increasing dangerously. Among ornamental plants young whitethorn (*Crataegus*) was injured by *Phyllobius oblongus*, L. Hyacinth, tulip and

amaryllis bulbs were attacked by the root mite, *Rhizoglyphus echinopus*, F. & R., introduced from Holland and previously recorded in Finland from oats only. Spruce was attacked by *Lygaeonematus abietinus*, Christ. *Tyroglyphus* (*Aleurobius*) *farinae*, DeG., was numerous in cereals stored in a public building.

In 1925 an early spring and unusually warm midsummer resulted in an increased abundance of pests, and crucifers were severely injured by Halticids and *Phaedon cochleariae*, F., beet by Silphids and cereals by *Oscinella* (*Oscinis*) *frit*, L. The Noctuid, *Euxoa* (*Agrotis*) *segetum*, Schiff., proved very destructive to young rye, and *Limothrips denticornis*, Hal., caused white-ear in rye.

In some localities fruit trees were attacked by *Chloroclystis rectangulata*, L.,and *Argyroploce variegana*, Hb.

Strawberries were attacked by *Philaenus leucophthalmus*, L. (*spumarius*, auct.) and *Otiorrhynchus ovatus*, L., the latter being a first record in Finland from this plant. Greenhouse roses were attacked by a new pest, *Notocelia rosaecolana*, Dbl. Pines were attacked by *Panolis flammea*, Schiff., and oaks by *Tortrix viridana*, L.

[Berezina (V. M.) & Kurentzov (A. I.).] **Березина (В. М.) и Куренцов (А. И.). Insects—Cone and Seed Pests of Pine and Fir occurring in the District of Leningrad.** [*In Russian.*]—*Bull. Plant. Prot.* (1, Ent.) no. 7, 52 pp., 4 figs., 3 graphs, 2 pls., 71 refs. Leningrad, 1935. (With Summaries in English pp. 20 & 44). Price 2 *rub.*

In view of the need for healthy material for the proposed afforestation of large areas of land in the Russian Union, observations were carried out in April–October 1932 in the Leningrad Department on insects infesting the cones and seeds of pine and spruce. The results are presented in three papers.

The first (pp. 7–24), by V. M. Berezina, contains notes on the bionomics of injurious insects other than Lepidoptera. They are divided into two groups, those attacking pine cones and those attacking spruce cones and seeds. Of the former, *Pissodes validirostris*, Gyll., was the most important. There is one generation a year. The adults hibernate under the scales of the outer bark of the trunks. Old weevils were found overwintering together with the young ones ; the adults seem to live for more than a year. The supplementary feeding on cones, which exude resin as a result of puncturing by the weevils, takes place in June and is followed by oviposition at the end of the month or beginning of July. From 1 to 4 eggs are laid in or on the cone. The larvae hatch in 7–10 days and burrow into the cone, where they feed on the pith and the base of the scales. They pupate in the cones about the end of July, and the young adults begin to emerge from the first week in August. This species only occurs in dry thinned stands of pines of varying age, where there is plenty of light. Cones that set in the preceding year and those that grow in the upper part of the crown are particularly liable to attack, the better developed trees that bear a greater number of cones being more severely infested. Infested cones shrivel up and die. In 1932, about 15 per cent. of the larvae of the weevil were parasitised by a Braconid, which like its host was concentrated in the upper part of the crowns. Insects associated with *P. validirostris* included *Dioryctria abietella*, Schiff., *Brachyderes incanus*, L., and *Aradus cinnamomeus*, Panz.

Pests causing indirect injury to pine cones were *Myelophilus* (*Blastophagus*) *piniperda*, L., *M.* (*B.*) *minor*, Htg., and *Monochamus galloprovincialis*, Ol. Their maturation feeding damaged the shoots bearing cones, and *M. galloprovincialis* sometimes fed on the epidermis of green cones as well. The larvae of the weevil, *Anthonomus varians*, Payk., developed in male inflorescences and prevented pollination. After about 3 weeks they pupate inside the flowers; the pupal stage lasts 3–10 days. The larvae are attacked by *Formica fusca*, L.

From 1 to 25 per cent. of spruce cones were infested by *Ernobius abietis*, F., which was common in dry thinned stands, especially in those growing on slopes. The larvae occurred from May to the end of September, the pupae from the end of June to October and the adults from mid-July onwards. As the larvae became particularly abundant from mid-August, there was probably a second generation, which hibernated in the larval and pupal stages. Observations showed that eggs are laid on cones that are on the trees, and the larvae, besides feeding on the axis of the cones, also attack the base of the scales and the seeds. The author therefore dissents from Trägårdh's view that *E. abietis* has little economic importance [*R.A.E.*, A **13** 104]. *Dasyneura* (*Perrisia*) *strobi*, Winn., was very common in all types of spruce stands, somewhat greater preference being shown for damp forests. The rate of infestation reached 53·3 per cent., and as many as 17 pupae occurred in one cone. By developing in the base of the scales and in the wood of the cones, the larvae weaken them, decrease the number of germinating seeds and prevent the cones from opening. Of the parasites of *P. strobi* recorded in the literature [**9** 608], *Torymus azureus*, Boh., was found by the author. *Megastigmus abietis*, Seitn., which destroys the seeds of spruce [**9** 607], was rare. An annotated bibliography is appended.

The second paper, by A. I. Kurentzov (pp. 25–46), deals with injurious Lepidoptera, of which *Cydia* (*Laspeyresia*) *strobilella*, L., was the most important. From 20 to 60 per cent. of the spruce cones, each usually harbouring 2–3 larvae, were infested. The germination of seeds in cones containing one larva decreases by 28 per cent., and in those containing two, three or four larvae by 32, 35 and 60 per cent., respectively. In 1932 single adults appeared in the first half of June. The simultaneous occurrence at the end of August of larvae both inside the axis of the cones and in mines in the scales seemed to indicate that there were two generations, possibly with a biennial cycle of development. The greatest infestation occurred in damp spruce stands situated on elevated watersheds, since in such stands the seeds take longer to develop and the moths are able to emerge before the cones drop to the ground. Trees exposed to light were most heavily infested. From the second half of July the larvae were parasitised by two species of Ichneumonids and one Chalcidoid, which between them destroyed in some stands up to 50 per cent. of the host. Woodpeckers and squirrels, by picking the cones from the trees and leaving them on the ground, exposed the larvae to conditions unfavourable for their development and to the attack of numerous predators. A list is given of the insects found associated with *C. strobilella*. The infested cones were sometimes attacked by the fungi, *Chrysomixa pirola* and *Pucciniastrum padi*, of which only the latter was fairly common. *Rhyacionia* (*Evetria*) *margarotana*, H. S., occurred in great numbers in dry thinned stands of pine slightly damaged by fire, and attacked tall trees exposed to light. Over 40 per cent. of the cones were sometimes infested. A single egg

is deposited on a cone in the second half of June, and the larvae at first mine under the surface and then boring deeper cause exudation of resin, and later destroy the seeds. They remained in the cones until the end of September, and hibernated as pupae. *Hyphantidium terebrellum*, Zk., also caused much damage. In the second half of July and beginning of August, 1–2 eggs are laid on cones on spruce trees, and the young larvae bore into the base of the scales and then make a spiral passage along the periphery of the axis, causing exudation of resin. The infested cones break easily and fall to the ground. Pupation takes place in the cone. In the laboratory the pupal stage lasted about 2 weeks, the adults emerging from 1st July. The life-cycle is probably completed in two years, since larvae of different instars occurred simultaneously at the end of the summer and in the autumn, and in June only some of the larvae pupated. The moth is able to develop in different types of stands, which may vary greatly in humidity and light. *Dioryctria abietella*, which in 1932 destroyed 2–3 per cent. of the yield of spruce cones but seldom attacked pines, developed in galls of *Chermes* spp., abandoning them in August when the larvae probably migrated to shoots [but *cf.* **19** 125]. Such migration was observed in the laboratory. There is probably one annual generation. If the summer is warm, however, a partial second generation may be produced, as was the case in the open in 1932, when first instar larvae were found in some of the cones in the second half of September. Information from the literature [**13** 68] is given on *Eupithecia* spp., which infest spruce cones but were scarce. The larvae of *Rhyacionia* (*Evetria*) *resinella*, L., developed inside pine shoots, but when the infested shoots broke off the cones went with them. A short key to the Lepidopterous pests of pine and spruce cones is based on the morphological characters of the larvae.

The third paper (pp. 48–51), by V. M. Berezina, consists of a key to the insect pests of cones and seeds of pine and spruce. It is based on the sort of injury caused. In some cases descriptions of the larvae and adults are also given.

CUSCIANNA (N.). **La *Sesamia cretica* Led. (nottua del granoturco) in provincia di Trieste.** [The Maize Noctuid, *S. cretica*, in the Province of Trieste.]—*Boll. Lab. Ent. Bologna* **7** (1934) pp. 241–262, 12 figs., 22 refs. Bologna, 20th May 1935.

Over most of the province of Trieste, *Sesamia cretica*, Led., is a more important pest of maize than *Pyrausta nubilalis*, Hb. It is primarily a pest of the stems and cobs of maize, but perhaps attacks other Graminaceae such as *Sorghum*. The morphology is described in detail. The mature or nearly mature larvae hibernate. In 1932, 1933 and 1934 the first adults emerged in the laboratory on 25th May, 1st May and 25th April respectively. Cold weather in winter and spring was responsible for the lateness of emergence in 1932. Emergence continued into the first half of June. The eggs are usually laid singly on the leaves. A female that oviposited from 2nd to 10th June laid 300 eggs. Incubation took 8–10 days. The first generation larvae began to appear in the second half of June, and the second in the second half of August. The larvae fed on the leaves of young plants or inside the stalks of older ones. Late larvae of the first generation and larvae of the second mined the cobs. The injury is fully described. The larval stage averaged 40 days. The pupal stage lasted at least 20 days and in the case of overwintered

larvae sometimes lasted 40 days. Pupation takes place inside the stalks, on the leaves, or at the base or the tip of the cob. Each stalk or each cob could harbour 4–5 larvae, and in some cases 80 per cent. of the maize plants were infested.

Young larvae are quite resistant to low temperatures, but the overwintering larvae succumb to late and severe cold ; they were destroyed by temperatures of −7 or −8°C. [19·4–17·6°F.] in January and February. Moisture favours the development of the larvae, which did well in plants exposed to rain, but usually died in plants shielded from it. Rain and wind sometimes swept the larvae from the plants.

The parasites recorded in the literature are noticed but none was observed. The chemical control employed against *P. nubilalis* in other countries is briefly outlined, but the author believes that although such measures might be experimentally successful against *S. cretica* in Italy, the difficulty of determining under practical conditions the proper time to apply them and the cost of the repeated applications that would be necessary in view of the life history of the Noctuid would make them unsatisfactory. Infested stalks should be destroyed before the end of April by feeding them to cattle or burning them as fuel ; stalks should be stored under cover and not left exposed to rain. Infestation could be reduced by planting not earlier than the end of May, and the plants from some very early sowings could be used as traps.

Malenotti (E.). **Contro la** *Recurvaria nanella*, **Hübn.**—*Atti Accad. Agric. Sci. Lett. Verona* (5) **13** pp. 129–133, 2 pls. Verona, 1935.

Recurvaria nanella, Hb., is an orchard pest of some importance in the province of Verona, where it sticks together the blossoms and shoots of fruit trees. In spring 1935 peaches were attacked, up to 50 shoots on 8 year old trees being affected. The attack by *R. nanella* occurs at least 20 days before that by *Cydia molesta*, Busck, and from 1 to 2 weeks before that by the overwintered larvae of *Anarsia lineatella*, Zell. The differences in the anal combs are also described. The larvae of *R. nanella* hibernate chiefly in cracks in the bark, leaving these shelters when the shoots appear. As a result of an application, made between 5th and 20th February, of some proprietary tar distillates against *Epidiaspis* (*Diaspis*) *leperii*, Sign., the number of peach shoots infested by *R. nanella* was reduced by between 93 and 99 per cent.

de Meijere (J. C. H.). **Ueber** *Craneiobia lawsonianae* **de Meij., eine Gallmücke aus den Früchten von** *Chamaecyparis lawsoniana* **(Dipt. Itonididae).** [*C. lawsonianae*, a Gall-midge from the Fruits of *C. lawsoniana*.]—*Tijdschr. Ent.* **78** no. 1–2 pp. 129–133, 8 figs. Amsterdam, June 1935.

Descriptions are given of the adult and larva of *Craneiobia lawsonianae*, sp. n., the larva of which lives in the fruits of *Chamaecyparis lawsoniana* in Holland.

Joessel (P. H.). **Remarques sur la biologie du Carpocapse.**—*Bull. trim. Off. rég. agric. Midi* no. 53 pp. 23–32, 17 refs. Marseilles, January 1935. [Recd. August 1935.]

Around Avignon some varieties of apple in untreated orchards are very heavily infested by *Cydia pomonella*, L. Because of the strict

French regulations on arsenical insecticides and obscure points in the biology of the moth, infestation remains serious even after spraying. On 13th March 1934 larvae in various stages of development were found under the bark of old apple trees that had never been subject to treatment. Fresh excreta proved that they were active. This fact is not surprising, as the larvae of *C.* (*Laspeyresia*) *molesta*, Busck, are able to mine branches [*cf.* also *R.A.E.*, A **19** 518]. Adult emergence of *C. pomonella* from overwintered larvae extended over a considerable period ; the presence in early April of larvae that had not yet pupated indicated the overlapping of adults from two generations of larvae. The first attempts at mining the fruits were noticed on 1st June in 1933 and on 27th May in 1934. On 2nd, 3rd and 6th August 1934 larvae varying from 2 to 8 mm. in length were entering pears, and it was considered that the older ones must already have been feeding in another fruit or on leaves. When the yield of apples and pears was small, the percentage of infestation in apricots increased and infestation of peaches became common. When apples and pears gave a normal crop, infestation of stone-fruits was rare. Apples and pears that ripened neither early nor late were most severely infested, as they were attacked by the larvae of both generations. As blossoming near Avignon usually occurs at the end of March or early in April, spraying when the petals fall precedes the hatching of the first larvae by nearly two months. It is not enough to poison the calyx, as the larvae enter into the fruit at other places. It is concluded that spraying must be repeated at intervals right up to harvesting time, that the leaves must be sprayed as well as the fruits, and that French regulations on arsenical insecticides need revision. For application just before the harvest, cryolite, barium fluosilicate or nicotine tannate appeared satisfactory.

Jannone Lodispoto (G.). **Alcuni rilievi sulle attuali conoscenze biologiche della** *Cydia* (*Carpocapsa*) *pomonella* **(L.).** [Some critical Notes on the present biological Knowledge of *C. pomonella*.] —*Ortofruttic. ital.* **4** no. 5 reprint 6 pp., 4 figs., 15 refs. Rome, 1935.

After a survey of published work in Italy on the biology of *Cydia pomonella*, L., the statements made by Joessel [see preceding abstract] are criticised. The statement that active larvae of *C. pomonella* in various stages of development were seen on 13th March is remarkable because they must have been mining the wood of the trunk, for at that date there could have been no green shoots or leaves for food. The author doubts if a single observation, supported only by similar behaviour in *C. molesta*, Busck, is enough to prove that the larva of *C. pomonella* does in fact mine in the wood.

André (M.). **Une invasion d'acariens à la Baule.**—*La Nature* **63** no. 1 pp. 542–543, 1 fig. Paris, 15th June 1935.

The Acarid, *Glycyphagus domesticus*, DeG., is recorded from a newly built house in Brittany. The mite prefers sugary substances, but attacks also all kinds of organic materials such as fur, feathers, etc., in which, given damp and darkness, it multiplies with great rapidity. In sugar warehouses *G. domesticus* may be controlled by fumigating with sulphur dioxide for 48 hours.

Borchers (F.) & May (E.). **Methoden zur Prüfung von Pflanzenschutzmitteln. VIII. Betrachtungen und Untersuchungen über die physikalischen Eigenschaften staubförmiger Pflanzenschutzmittel.** [Methods for testing Insecticides and Fungicides. VIII. Observations and Investigations on the physical Properties of Dusts.]—*Mitt. biol. Reichsanst.* no. 50 pp. 5–55, 11 figs., 19 refs. Berlin, April 1935.

The practical value of a dust insecticide depends quite as much on its physical properties as on chemical properties and physiological effects. In this paper [*cf. R.A.E.*, A **22** 385, etc.], the various physical properties requisite are discussed and methods for determining them are described in detail. The following is taken from the summary of conclusions: The capacity for coating a plant, either by impact or by settling, without the aid of complicated dusting machinery, depends on the size of the grains, the distribution of grains of varying size and the space between the grains. These factors also govern the capacity for remaining in suspension in the air and the uniform density of a dust cloud. Dusts made up of grains of varying size or with insufficient space between the grains are unsuitable for dusting by impact or by settling. Dusts intended for deposition by settling must have especially fine grains of uniform size separated by spaces as wide as possible. These qualities are not so important in dusts applied by impact. Resistance to jarring is best tested with Görnitz's apparatus as modified by Voelkel [*R.A.E.*, A **17** 641]. Resistance to wind and rain should be investigated along the lines adopted by Barnes & Potts [**18** 211], the resistance to wind being tested by means of Reckendorfer's method [**20** 384] and that to rain by a new method in which plates are coated with dust, some being immersed in water and others sprayed by means of Görnitz's apparatus [**21** 385]. Further work needs to be done on Moore's conclusions [**13** 333] about the effect of electrostatic charging of the particles.

Fischer (W.) & Nitsche (G.). **Methoden zur Prüfung von Pflanzenschutzmitteln. IX. Die Brauchbarkeit einiger Schnellmethoden zur chemischen Prüfung von Derris-Extrakten und ihr Vergleich mit der biologischen Prüfung derselben Extrakte an Kiefern- und Seidenspinnerraupen.** [Methods for testing Insecticides and Fungicides. IX. The Usefulness of some rapid Methods of chemically testing Derris Extracts and its Comparison with a biological Test of the same Extracts on Larvae of the Pine Lasiocampid and Silkworm.]—*Mitt. biol. Reichsanst.* no. 50 pp. 57–78, 2 graphs, 8 refs. Berlin, April 1935.

Two new colorimetric methods for determining the rotenone in derris are described. These and two other rapid methods of chemical examination, the polarimetric and the simplified Takei methods, were applied to a number of derris extracts. The results of these four methods are compared with each other and with those of physiological tests and are tabulated. The test insects were the larvae of *Dendrolimus pini*, L., and *Bombyx mori*, L., placed in apparatus designed by Lang & Welte [*R.A.E.*, A **18** 701]. The polarimetric method gave results most indicative of the effect on insects, the Takei method coming next. The non-polarimetric tests are of value as controls in cases where polarimetry becomes unreliable owing to the presence of strongly polarisable substances other than rotenone, or in cases where

only a little material (and that poor in rotenone) is available for testing. In spraying tests rotenone was found to be responsible for the contact action of derris extracts on insects, other constituents being comparatively unimportant. A dust containing derris roots acted rapidly and powerfully and then lost power, whereas a dust containing an extract of the same roots had an action that began gradually and increased through the course of a week. Both dusts contained the same proportions of rotenone and rotenone resin.

WIMMER (—). **Auftreten der Douglasienlaus im südwestdeutschen Walde.** [The Occurrence of the Douglas Fir Chermes in south-western German Forests.]—*Anz. Schädlingsk.* **11** no. 6 pp. 61–63, 5 figs., 4 refs. Berlin, June 1935.

Since May 1933 *Chermes* (*Gilletteëlla*) *cooleyi*, Gill., has been observed on Douglas fir [*Pseudotsuga taxifolia*] in several localities in south-western Germany, where it was probably introduced from Scotland. The winter forms occurred up to the end of March closely pressed to the lower side of the needles. In 1928 this pest was discovered in Holland [*R.A.E.*, A **17** 635].

ZACHER (F.). **Beobachtungen über Speicherinsekten.** [Observations on Warehouse Insects.]—*Anz. Schädlingsk.* **11** no. 6 pp. 63–66, 1 fig. Berlin, June 1935.

In 1934, *Typhaea stercorea*, L., was found in stored wheat in Silesia. It occurs in warehouses only in the presence of moulds, and like *Mycetophagus quadriguttatus*, Müll., and *Alphitophagus bifasciatus*, Say, is of no great importance. Reference is made to the discovery in Germany of *Aphomia gularis*, Zell. [*R.A.E.*, A **23** 431]. Dried plums have been especially infested. In breeding experiments the larvae accepted cacao, dried plums and clover seed. This Pyralid appeared to have two generations a year. Another new pest, *Tribolium destructor*, Uytt. [**22** 229], has been found in stored seeds of various plants in several localities in Germany and in malt at Le Puy (France). Notes are given on the species of ants infesting mills and warehouses, in Germany, Italy and Egypt. The Chinese Bruchid, *Bruchus* (*Callosobruchus*) *glaber*, Allib., hitherto unknown in Europe, was found infesting *Cicer arietinum* in Genoa harbour. Like *B.* (*C.*) *chinensis*, L., it oviposits in the dried seeds and develops in them.

EIDMANN (H.). **Eine interessante Schädlingsfolge an Pappel.** [An interesting Sequence of Pests on Poplar.]—*Anz. Schädlingsk.* **11** no. 6 pp. 66–67, 1 fig. Berlin, June 1935.

In Germany poplar twigs were found to have been infested by *Saperda populnea*, L., the larvae of which had been pecked out by a woodpecker, leaving débris only in the mines. The mines also contained the cocoons of Sphegid wasps.

WELLBORN (V.). **Schabenbekämpfung mit " 808 "-Präparaten.** [Cockroach Control with " 808 " Products.]—*Anz. Schädlingsk.* **11** no. 6 pp. 67–68, 1 fig. Berlin, June 1935.

In tests with " 808 " chemicals and cockroach traps [*R.A.E.*, A **23** 288] 5,130 cockroaches were captured in two rooms in 21 days. The

" crippling powder " adhered to the feet of the cockroaches, thus prevented them from climbing out of the traps, and subsequently coated their bodies.

Evans (J. W.). **Thrips Investigation. 6. Further Observations on the Seasonal Fluctuations in Numbers of *Thrips imaginis* Bagnall and associated Blossom Thrips.**—*J. Coun. sci. industr. Res. Aust.* **8** no. 2 pp. 86–92, 5 graphs, 6 refs. Melbourne, May 1935.

In conclusion of an investigation of the abundance of thrips in the neighbourhood of Adelaide [*R.A.E.*, A **23** 148, etc.], data are given on the abundance of *Thrips imaginis*, Bagn., *Haplothrips victoriensis*, Bagn., and *Isoneurothrips australis*, Bagn., in roses [*cf.* **22** 61], for the years 1932, 1933 and 1934. Records are also presented of the numbers of *T. imaginis* occurring daily in samples of 50 flowers of *Echium plantagineum* and *Cryptostemma calendulaceum* during the spring of each of these years and on apple blossom in 1933 and 1934. The abundance of *T. tabaci*, Lind., in the flowers of *E. plantagineum* during the spring months of these years is also dealt with. Whereas the first three indigenous species have decreased in abundance during the period over which observations have been made, *T. tabaci*, an introduced insect, has shown a progressive increase from 1932 to 1934. *T. imaginis* and *H. victoriensis* were most abundant during the summer months after the winter of 1932. A study of *T. imaginis* over a period of 5 years has led to the conclusion that fluctuations in its numbers are entirely dependent upon climatic influences and are not bound up with any rhythm that can be accounted for either by the effect of predators or by a change in the virility of the species following an epidemic season. During the months of February and March the abundance of the thrips is practically identical each year, the subsequent progress of population density depending solely on meteorological events. The effect of climatic influences on the increase of *T. imaginis* for the years 1930–1933 has already been discussed [**22** 448]. The absence of any important increase in abundance during 1934 can be correlated with the amount of rain in the autumn and spring. From the beginning of April until the end of July 1934, only 364 points of rain were recorded, as compared with 1,444 points in 1931 and 1,605 points in 1932.

Vayssière (P.). **Sur la biologie peu connue de trois Coléoptères de nos colonies.**—*Bull. Soc. ent. Fr.* **40** no. 10 pp. 160–162, 1 pl., 5 refs. Paris, 1935.

Among the species dealt with is the Lamiid, *Ecthoea quadricornis*, Ol., which infests the shoots of coffee in French Guiana.

Section of Plant Quarantine and Inspection.—*J. econ. Ent.* **28** no. 3 pp. 505–552. Geneva, N.Y., June 1935.

This series of papers includes A Review of Plant Quarantine Work in 1934, by A. S. Hoyt (pp. 505–514), in which in addition to a survey of domestic plant quarantines, notes are given on insects and diseases of plants intercepted from abroad and on new or rare insects in the United States. In Possible future Policies in Plant Quarantine Work (pp. 514–515), L. A. Strong compares Quarantine no. 56, which prohibits the introduction of fruit and vegetables into the United States if they present a definite risk of pest introduction, but otherwise provides for their admission in any quantity, with Quarantine no. 37,

which allows for the unlimited import of certain types of nursery stock, plants and seeds, whereas other types are admitted only in limited quantities, and constitutes rather a trade protection quarantine than one based on pest risks. In Treatment of imported Spanish Grapes and other Foreign Quarantine Developments during the Year, by E. R. Sasscer (pp. 516–519), the successful sterilisation of grapes imported from parts of Spain where *Ceratitis capitata*, Wied., is known to occur [*cf. R.A.E.*, A **23** 236] is described, and quarantine problems that have recently developed and certain alterations in existing regulations are discussed. In The Japanese Beetle Outbreak in St. Louis, Mo., and its Control, by C. W. Stockwell (pp. 535–537), details are given on the control of an outbreak of *Popillia japonica*, Newm., by means of soil treatment with lead arsenate at the rate of 1,000 lb. to the acre against the larval population resulting from oviposition in the summer of 1934. In Restricted Areas in otherwise healthy Nurseries (pp. 545–546), W. W. Ellenwood explains that in Ohio nursery certificates are issued subject to special restrictions on infested plots in otherwise healthy nurseries, so that nurserymen are encouraged to suppress local outbreaks on their own premises without being prevented from doing business during the destruction or treatment of their faulty stock. Other papers are Dutch Elm Disease Eradication in the United States, by L. H. Worthley and O. N. Liming (pp. 524–528) [*cf.* **23** 456], Report of the National Plant Board for 1934, by W. C. O'Kane (p. 547), Report of the Eastern Plant Board, by E. N. Cory (pp. 547–548), Report of the Central Plant Board, by P. T. Ulman (pp. 548–549), and Report of the Western Plant Quarantine Board, by A. C. Fleury (pp. 550–552).

R. K. Beattie, in Research during 1934 on *Ceratostomella ulmi*, the Cause of Dutch Elm Disease (pp. 528–531), states that work in 1934 has tended to confirm the theory that the causal organism of the disease was imported from Europe in burl elm logs. Accumulated evidence indicates that *C. ulmi* may move from one annual ring to those of succeeding years, but there is no evidence yet available to show that it can move from an infected ring to those of preceding years. Of 4 trees found in Indianapolis in 1934 within half a mile of a veneer factory, one showed *C. ulmi* in the 1926, 1929, 1931, 1933 and 1934 annual rings, the second in the 1928, 1929, 1932, 1933 and 1934 rings, the third in the 1929, 1933 and 1934 rings and the fourth, which was nearly dead, in the 1934 ring only. Assuming that the disease can move centrifugally and not centripetally, the tree that showed the presence of *C. ulmi* in the 1926 ring had probably been infected for 8 years and is the oldest infection yet discovered in America [**23** 456]. These trees may represent independent infections resulting from log importations in 3 different years ; they may be due to a few undiscovered Scolytid beetles transmitting *C. ulmi*, or to some unknown carrying agent. Present knowledge of the entry and movement of elm logs, which leaves unexplained only one known case of infection in the United States, is summarised. This tree was found on the east side of the mouth of the Connecticut River, 70 miles from the New York City area of infection. Investigations to discover other possible means of entry of *C. ulmi* into America have shown that crates, frequently made from elm sticks, which have been used for a number of years to ship cheap china from England to New York and Boston, sometimes contain *Scolytus multistriatus*, Marsh. Although generally unpacked and discarded at the port of entry, these crates have occasionally been sent to other points in the United States.

FLANDERS (S. E.). **New Host Records for two Mealybug Parasites.**—*J. econ. Ent.* **28** no. 3 p. 552. Geneva, N.Y., June 1935.

The Encyrtid, *Acerophagus pallidus*, Timb. [*cf. R.A.E.*, A **9** 101], was reared in small numbers in southern California in the autumn of 1934 from a large quantity of *Phenococcus gossypii*, Tns. & Ckll., only the immature stages of which appear to be attacked. The only previously recorded host was *Erium* (*Pseudococcus*) *eriogoni*, Ehrh. Another Encyrtid, *Pseudaphycus angelicus*, How., which seems to attack mature as well as immature females, was reared from *Phenacoccus gossypii* collected in Central California, previously recorded hosts being *Pseudococcus adonidum*, L., *P. ryani*, Coq., and *P. maritimus*, Ehrh. Both species are readily reared in the insectary.

WYMORE (F. H.). **The Olive Scale,** *Parlatoria oleae* **Colv.**—*J. econ. Ent.* **28** no. 3 p. 552. Geneva, N.Y., June 1935.

Parlatoria oleae, Colv., is recorded for the first time on olives in California, where about 17 acres were found to be infested in October 1934. The smaller branches, leaves and fruit were attacked and the crop was quite spoiled for tinning purposes. Scales became noticeable on the trees, which were planted 20 years ago, only in 1931, and have since become increasingly injurious. One application of 3 per cent. commercial oil emulsion spray did not give effective control.

Section of Apiculture.—*J. econ. Ent.* **28** no. 3 pp. 553–601, 5 figs. Geneva, N.Y., June 1935.

This series of papers includes the following : Studies in Bee Activity during Apple Bloom, by W. H. Brittain (pp. 553–559), which supplements the results of other studies already noticed [*R.A.E.*, A **22** 35] ; The Effect of certain Bactericides, especially Copper Sulphate, on the Longevity of Honeybees, by E. M. Hildebrand and E. F. Phillips (pp. 559–565) ; some Effects of relative Humidity on the Length of Life and Food Consumption of Honeybees, by A. W. Woodrow (pp. 565–568) ; Observations on the Biology of the Greater Wax Moth, *Galleria mellonella*, L., by V. G. Milum and H. W. Geuther (pp. 576–578), in which are recorded a few points about oviposition and larval feeding not commonly given in the literature ; and Further Observations on the Flight Range of the Honeybee in Relation to Honey Production, by A. P. Sturtevant and C. L. Farra (pp. 585–589).

J. E. Eckert and W. H. Allinger, in Airplane Dusting and its Relation to Beekeeping (pp. 590–597), point out that the drift of poisonous dusts that invariably accompanies applications from aeroplanes covering large tracts of land is dangerous to the bee-keeping industry. The honeybee collects the dusts together with the pollen and stores the poisoned pollen in its combs where it constitutes a source of poison for the nurse bees as they prepare food for the larvae. As field bees gathering poisoned water and nectar are incapacitated in the field and the nurse bees in colonies seriously affected by dust poisoning generally die outside the hive before they have an opportunity to feed the larvae or queen, the larvae generally die of starvation and exposure and the queens are generally the last of the bees to disappear. Various measures intended to avoid or diminish the chances and effects of injury include soaking the combs in water for 48 hours to free them from poisoned pollen before giving them to other colonies.

Section of Extension.—*J. econ. Ent.* **28** no. 3 pp. 602–620. Geneva, N.Y., June 1935.

In addition to papers separately abstracted this section includes: The Codling Moth Situation in Pennsylvania, by H. E. Hodgkiss (pp. 609–612). The present Status of Codling Moth Control in Ohio, by T. H. Parks (pp. 612–613), and Codling Moth Control Program in the Shenandoah-Cumberland Fruit Region, by W. S. Hough (p. 614), which give details of the spray schedules used during the past year in each of the respective regions, and of the degree of success achieved in each case in controlling *Cydia pomonella*, L., in 1934.

Huckett (H. C.) & Hervey (G. E. R.). **Recent Developments in the Use of Arsenical Substitutes for Vegetable Pest Control in New York.**—*J. econ. Ent.* **28** no. 3 pp. 602–603. Geneva, N.Y., June 1935.

In experimental work against pests of cabbage and cauliflower in Long Island and western New York there was little difference between derris and cubé [*Lonchocarpus*] root in dust mixtures of 0·5–1 per cent. rotenone content, but dusts of 0·33 per cent. rotenone content were considerably less efficient. Talc, clay, finely ground gypsum and sulphur-clay were satisfactory diluents or carriers. Spray mixtures containing derris powders were slightly better than those containing cubé powder, but not quite as good as the dusts. Spray mixtures containing 3–4 lb. powdered derris root of 5 per cent. rotenone content to 100 U.S. gals., with a suitable spreader, such as 5 U.S. qts. liquid coconut oil soap, 2 U.S. qts. penetrol or 4 lb. powdered skim-milk, gave promising results. Acetone extract of derris root (5 per cent. rotenone content), at the rate of 1½ U.S. qts. per 100 U.S. gals. spray, with soap as a spreader, was about as good as 3 lb. powdered derris root (4 per cent. rotenone content). The cabbage looper [*Phytometra brassicae*, Riley] is more troublesome to control than other green larvae on cabbage, but it is not known whether this is due to actual immunity from the poison or to other factors. The zebra caterpillar [*Ceramica picta*, Harr.] has been practically unaffected by applications of derris, cubé or pyrethrum powder, and control of cabbage Aphids [*Brevicoryne brassicae*, L.] has similarly failed on Long Island. Dusting with nicotine-lime mixtures controlled both these pests without interfering with derris or cubé treatment against other insects. Derris and cubé spray and dust mixtures have given promising results against *Thrips tabaci*, Lind., on cauliflower and against the Mexican bean beetle [*Epilachna corrupta*, Muls.] on lima and snap beans, but neither were effective against the corn ear worm [*Heliothis obsoleta*, F.].

Walker (H. G.) & Anderson (L. D.). **Summary of Results obtained with Arsenical Substitutes for the Control of Vegetable Crop Insects at the Virginia Truck Experiment Station.**—*J. econ. Ent.* **28** no. 3 pp. 603–605. Geneva, N.Y., June 1935.

Derris and pyrethrum dusts have been tested in Virginia against *Phytometra* (*Autographa*) *brassicae*, Riley, *Plutella maculipennis*, Curt., *Diabrotica melanocephala*, F. (*vittata*, F.), *Heliothis obsoleta*, F., *Epilachna corrupta*, Muls., *Epitrix cucumeris*, Harr., *Thrips tabaci*, Lind., *Anasa tristis*, DeG., *Murgantia histrionica*, Hahn, *Brevicoryne brassicae*,

L., *Macrosiphum* (*Illinoia*) *solanifolii*, Ashm., and *Myzus persicae*, Sulz. Details of the results obtained and the relative efficiency of various carriers are briefly discussed.

HEADLEE (T. J.). **Derris as an Arsenical Substitute on Vegetables.**—*J. econ. Ent.* **28** no. 3 pp. 605–607. Geneva, N.Y., June 1935.

During 1934 experimental work on derris against insects on vegetables in New Jersey was mainly directed against the Mexican bean beetle [*Epilachna corrupta*, Muls.]. Tests with six different strengths and types of derris dusts showed that materials made up with ground derris were much more effective in reducing feeding injury to foliage than those composed of impregnated dusts. Reinfestation occurred earliest where impregnated dusts had been used. It was later on foliage treated with ground derris, and latest of all after the application of a dust containing 16 parts ground derris (5 per cent. rotenone), 25 parts fine ground dusting sulphur and 59 parts clay. The use of metal hoods 6 ft. long, 1 ft. wide and 14 inches high made it possible to get satisfactory coverage and total mortality with 10 lb., whereas 25–30 lb. were necessary if hoods were not used. Results obtained with derris dusts against other insects are briefly reviewed, the only species failing to respond to derris or any other arsenical substitute being the corn ear worm [*Heliothis obsoleta*, F.], which caused serious injury to celery. The larvae, however, are killed by derris extract applied hypodermically.

WHITE (W. H.). **A Summary of Studies on arsenical Substitutes for Cabbage Worm Control on Cabbage and Limitations on Arsenical Treatments.**—*J. econ. Ent.* **28** no. 3 pp. 607–609. Geneva, N.Y., June 1935.

During three years' experiments in North and South Carolina, Louisiana and Ohio, derris and pyrethrum have on the whole been more effective than Paris green, calcium arsenate or natural or synthetic cryolite against the larvae of cabbage pests, principally *Phytometra* (*Autographa*) *brassicae*, Riley, *Pieris* (*Ascia*) *rapae*, L., *Plutella maculipennis*, Curt., and *Hellula undalis*, F., and they have not been much more costly than arsenicals or fluorine compounds. The efficiency of each of the materials is shown in relation to each species. Better results were obtained with dust mixtures than with sprays. Derris dusts containing from 0·5 to 1 per cent. rotenone gave the most satisfactory results, but fresh pyrethrum dust containing 0·9 per cent. total pyrethrins, mixed with 5 parts (by weight) of a diluent was also good. Several non-alkaline materials, including finely ground tobacco dust, finely pulverised clay, talc, diatomaceous earth, infusorial earth, and sulphur, proved satisfactory diluents for both materials. Good control was secured with a suspension of powdered derris root in water diluted to give the spray a rotenone content of 0·02–0·025 per cent. Commercial pyrethrum extract or a combination of pyrethrum and derris extracts gave fairly satisfactory results.

Experiments in 1932–33 and 1933–34 in South Carolina and Louisiana with both spring and autumn cabbage crops showed that cabbages ordinarily bearing 4 loose outer leaves may be treated with insecticides leaving harmful residues up to 40 days before harvest, whereas those ordinarily marketed without any stripping or with more than 4 loose outer leaves cannot be treated with arsenical insecticides at all.

Roney (J. N.) & Thomas (F. L.). **Arsenical Substitutes for Controlling Vegetable Insects.**—*J. econ. Ent.* **28** no. 3 pp. 615–617. Geneva, N.Y., June 1935. **Arsenical Substitutes for Controlling certain Vegetable Insects.**—*T.c.* pp. 618–620.

In the first paper a brief account is given of the results of a three years' investigation of arsenical substitutes in Texas against *Pieris rapae*, L., *Phytometra* (*Autographa*) *brassicae*, Riley, and *Plutella maculipennis*, Curt., on cabbage and *Heliothis obsoleta*, F., on tomato. In tests conducted between 21st April and the end of June, during which period the minimum temperature was 50°F. and average temperatures were above 70°F., treatments were started as soon as the larvae appeared and 2–3 applications proved sufficient to protect each of 3 cabbage crops. A dust containing 10 per cent. derris or 0·5 per cent. rotenone and 90 per cent. 300-mesh conditioned sulphur produced increases in yield of 2,500 lb. and 8,000 lb. of marketable cabbage to the acre in two experiments at a cost of about 2*s.* an acre for the material. A derris dust appeared to be the best of the insecticides tested against *H. obsoleta*.

The second paper deals with two years' experiments in the control of *Diabrotica balteata*, Lec., and *Empoasca fabae*, Harr., which together constitute the most important factor limiting the production of autumn beans in the southern part of Texas. Both may be controlled by the same application. Several types of sulphurs and pyrethrum-sulphur mixtures and a dust of copper sulphate and lime all proved effective. A pure sulphur gave better control than a conditioned sulphur of the same degree of fineness, but there was little difference in the effectiveness of a pure 200-mesh sulphur and a conditioned 300-mesh sulphur containing 2–2½ per cent. magnesium carbonate, and a 20–80 copper-lime dust was about equally effective. Though pyrethrum-sulphur mixtures were slightly better than sulphur alone, the margin of difference does not justify the extra cost involved. A 50 per cent. increase in yield has been produced by 2–3 applications of a 300-mesh conditioned sulphur applied at the rate of 20–25 lb. to the acre.

Dobroscky (I. D.). **Preliminary Report on the Fluorine Compounds as Insecticides.**—*J. econ. Ent.* **28** no. 3 pp. 627–637, 5 figs., 14 refs. Geneva, N.Y., June 1935.

The fluorine compounds, particularly natural cryolite, were found in the course of tests carried out in 1934 to give very good control of *Epitrix parvula*, F., and *E. cucumeris*, Harr., on tobacco, *E. fuscula*, Crotch, on egg plants, and *Epilachna corrupta*, Muls., on beans. In field tests natural cryolite proved to be 2 to 2½ times as effective as magnesium arsenate against *E. corrupta* on two varieties of bean.

In experiments with *Tribolium confusum*, Duv., the beetles were confined with lead arsenate and a fine grade of natural cryolite, used at concentrations of 100, 80, 60, 40 and 20 per cent., and readings for toxicity were made on the 3rd, 5th and 8th days. Lead arsenate produced high mortalities in a shorter time than natural cryolite, but although it was very toxic at 100 per cent., natural cryolite produced higher mortalities by the 8th day. At 80 and 60 per cent. the mortalities produced by the two insecticides were about equal on the 8th day, but at 40 and 20 per cent. cryolite gave about 60 per cent. mortality on the 8th day, whereas lead arsenate at these concentrations was only about half as toxic.

Studies carried out with honey bees to determine the reactions of natural cryolite with lime, Bordeaux mixture and lead arsenate showed that lime is incompatible with this material [*cf. R.A.E.*, A **19** 357] and decreases its toxicity. There appears to be no chemical reaction between lead arsenate and cryolite, the time required to secure 50 per cent. mortality of bees being the same for the mixture as for cryolite alone, but when Bordeaux mixture is added to cryolite, toxicity is reduced to one half [*cf.* **16** 120], probably on account of the reaction of the Bordeaux with the sugar solution in which the material must be fed to the bees, which increased the amount of water-soluble copper present. Whereas fluorine compounds cause the bees to die rather suddenly, those fed on lead arsenate remain in a comatose state for many hours before actual death takes place. The toxicities of various fluorine compounds studied was found to be in close correlation with the amount of fluorine present and available in a solution or suspension.

JANES (M. J.), HAGER (A.) & CARMAN (G. E.). **Preliminary Studies on Starvation and Drowning of the Chinch Bug,** *Blissus leucopterus* **(Say).**—*J. econ. Ent.* **28** no. 3 pp. 638–646, 5 figs., 1 ref. Geneva, N.Y., June 1935.

Studies carried out in Iowa in the summer of 1934 to determine the effect of food shortage and heavy rains on the migrations and populations of *Blissus leucopterus*, Say, showed that the bugs can survive 8–13 hours without food or water. Death from starvation, which in most cases takes place during the second, third and fourth days without food, occurs earlier at the higher temperatures, and lower relative humidities are usually accompanied by more rapid death rates. The later instars are able to withstand longer periods of starvation than the early instars or adults. In every case, insects having access to distilled water or to solutions of sucrose lived longer than the controls. An appreciable daily loss of weight accompanied starvation. *B. leucopterus* was able to recover in some cases after submergence in water for as long as 48 hours.

BLISS (C. I.). **Estimating the Dosage-Mortality Curve.**—*J. econ. Ent.* **28** no. 3 pp. 646–647. Geneva, N.Y., June 1935.

The method of estimating the dosage-mortality curve already noticed [*R.A.E.*, A **22** 440; **23** 493] is briefly discussed, and an improvement on the method of O'Kane, Westgate & Gover [**23** 104] is suggested.

ELLISOR (L. O.). **A Technique for Rearing the Corn Earworm,** *Heliothis obsoleta*, **Fab.**—*J. econ. Ent.* **28** no. 3 pp. 647–648. Geneva, N.Y., June 1935.

Fully mature larvae of *Heliothis obsoleta*, F., collected from ears of maize during the last week of September and first week of October were allowed to pupate in the greenhouse. The moths, which emerged about two weeks later, were confined in a wire cage in and around which young maize was growing. Water and a sponge saturated with a 10 per cent. sucrose solution were placed in the cage, the sponge being washed and saturated each day. The moths fed readily on the solution and began to oviposit 2 days after they emerged, laying their eggs promiscuously on the sides of the cage and on the growing maize. Most of the eggs hatched 4–5 days after oviposition. The larvae congregated

on the maize touching the cage and defoliated the plants in a few days, except for tough mid-ribs and veins of the leaves and lower stems. Larvae allowed to develop separately in glass jars containing maize kernels and damp sand were larger than those maturing on green maize plants. The moths began to emerge about 20th November, and another brood of larvae was obtained from them. These were fed on rape, which proved an excellent alternative food-plant, and owing to its succulence and rapid growth provided more food than maize in limited greenhouse space. The second brood larvae began to pupate about 1st December, but the moths resulting from these pupae were weak and laid infertile eggs. It is believed that further study will make it possible to breed larvae throughout the winter.

Knowlton (G. F.). **A Dewberry Fruit Worm.**—*J. econ. Ent.* **28** no. 3 p. 649, 1 fig. Geneva, N.Y., June 1935.

Larvae of a Tortricid, possibly *Ancylis comptana*, Froel., attacked the last berries of the dewberry crop in various localities in Utah during the years 1931–34 inclusive. The infestation is noticed when the berries are placed in water to be washed, when the larvae leave the fruit and float on the surface of the water. Attempts were made to rear adults in the autumn of 1934. The larvae transformed to prepupae within a few days to two weeks after the infested fruits were picked, but most of them died in this stage.

Jones (S. E.) & Mecom (W. H.). *Petrobia tritici* (**Ewing**) **on Onions and its Control.**—*J. econ. Ent.* **28** no. 3 p. 650. Geneva, N.Y., June 1935.

Petrobia tritici, Ewing, hitherto known only as a wheat pest, was found on unirrigated onions in Texas on 6th February 1935. If there was a wind, the adult mites kept to sheltered parts of the plants. They entered the ground at night. They were found in the seed bed and on plants pulled ready for transplanting. Infestation increased from 5 per plant on 6th February to 330 on 30th March. Only 3 fields of about 275 acres, in which onions had been grown continuously for some years, were found to be infested, and an infestation of the onion thrips [*Thrips tabaci*, Lind.] was also heavier in these fields than in others in the vicinity. Preliminary tests, in which a number of sulphur dusts and sprays were applied to experimental plots on 15th March at rates of 15 lb. dust and 200 U.S. gals. per acre, indicated that sulphur, especially in the form of a 300-mesh conditioned sulphur dust, gives satisfactory control of the mite, but none of the materials did much to reduce infestation by the thrips.

Hawley (I. M.). **Horizontal Movement of Larvae of the Japanese Beetle in Field Plots.**—*J. econ. Ent.* **28** no. 3 p. 656. Geneva, N.Y., June 1935.

In a further experiment under field conditions [*cf. R.A.E.*, A **22** 414], equal numbers of third instar larvae of *Popillia japonica*, Newm., collected in the field were placed on 22nd September 1933 in fumigated and prepared fallow and sod plots 24 ft. square. The positions of the larvae were determined in October 1933 and in May and June 1934. The average distances moved (in inches) by the dates of examination were 7·2,

11·0 and 17·4 in grass sod, and 12·0, 26·1 and 51·0 in the bare ground. More larvae were recovered from the sod plot. By June, 16 of the larvae in the sod had transformed to prepupae and 8 to pupae, but none had done so in the bare gound.

MOFFAT (U. J.) & ALLAN (W.). **A Preliminary Note on the White Borer of Coffee at Abercorn.**—*Ann. Bull. Dep. Agric. N. Rhod. 1933* pp. 39–41. Livingstone, 1934. [Recd. July 1935.]

This is an account of investigations during 1932–33 on the bionomics of *Anthores leuconotus*, Pasc. [*cf. R.A.E.*, A **17** 626], the only important pest of coffee in Northern Rhodesia, where it causes serious damage at altitudes up to 5,400 ft. In a caged area containing many trees adult emergence continued from the middle of November to the middle of December, and oviposition from 20th December until the middle of February. The pre-oviposition period averaged 30 days. The eggs were laid in shallow cuts in the stem about an inch above the surface of the soil. Females laid only one egg in each tree but visited as many as 26 trees. The males lived longer than the females, but all had died by the middle of March. The incubation period is apparently somewhat less than 10 days. The young larvae feed on the surface bark of the stem and then migrate through the soil to the roots, through which they bore upwards, coming out from time to time to feed on the bark of the large roots. The mature larva pupates in the tunnel, which by this time has been continued above the ground level. The pupal period probably lasts 20–30 days. The life-cycle from egg to adult extends over at least 23 months. From the middle of November to the middle of January the adults may be collected by hand. To destroy the larvae resulting from the remaining beetles, the stem of each plant should be rubbed with a square of sacking three times between the beginning of February and the end of March. Repellent paints or mechanical barriers placed at the base of the trees have not been satisfactory.

ALLAN (W.). **Notes on Control of Vegetable Pests.**—*Ann. Bull. Dep. Agric. N. Rhod. 1933* pp. 42–47. Livingstone, 1934. [Recd. July 1935.]

This is a popular account of vegetable pests in Northern Rhodesia. Short notes on methods of control are arranged under the popular names of the insects. Formulae for some of the sprays recommended are appended.

VOÛTE (A. D.). **Die Eientwicklung der Mehlmotte, *Ephestia kühniella* Zell., bei konstanten und schwankenden Temperaturen. Teil. I.** [The Egg Development of the Flour Moth, *E. kühniella*, at constant and fluctuating Temperatures. Part I.]—*Z. angew. Ent.* **22** no. 1 pp. 1–25, 10 graphs, 25 refs. Berlin, June 1935.

The following is taken largely from the summary of this detailed account of investigations at Munich.

In *Ephestia kühniella*, Zell., egg development ensuring hatching began at 10°C. [50°F.], and an increase to 16°C. [60·8°F.] caused only a slight increase in the rate of development. The greatest increase per

degree of temperature occurred between 16°C. and 26°C. [78·8°F.]. Between 26°C. and 32°C. [89·6°F.] the rate rose less rapidly per temperature unit and between 32°C. and 34°C. [93·2°F.] development was retarded. Relative air humidity had no noticeable effect on the duration of the development of the eggs, and humidities between 30 and 100 per cent. had, within a temperature range of 13–32°C. [55·4–89·6°F], no great effect on egg mortality. Nevertheless, it seemed probable that regularly alternating variations in humidity increased the mortality. Daily changes of temperature lasting for ½–1 hour were sufficient to affect the duration of development, and for this reason it is important in experimental work not to remove eggs from the thermostat for longer than 15 minutes. The mathematical representation of the conditions governing development is discussed. The author considers that the duration of development, and still more the speed of development are rather better expressed by three straight lines joining at 15°C. [59°F.] and 26°C., the part between these representing the optimum zone of development, than by a catenary line, or by a hyperbolic function. The temperature prevailing at the time of oviposition had considerable effect on the duration of development later on. A temperature of 15–26°C. at the time of oviposition combined with 26°C. during development appeared the most favourable in reducing egg mortality. It would consequently appear that the optimum range for the development of the egg of *E. kühniella* lies between 16 and 26°C. Examination of the data given by Payne for the total development of the moth [*R.A.E.*, A **21** 667] render it probable that the conditions governing the dependence of the duration of egg development apply also to total development.

HERFORD (G. M.). **Observations on the Biology of *Bruchus obtectus* Say, with special Reference to the nutritional Factors.**—*Z. angew. Ent.* **22** no. 1 pp. 26–50, 2 figs., 3 diagr., 19 refs. Berlin, June 1935.

This paper describes experiments on some obscure points in the bionomics of *Bruchus obtectus*, Say, quantitative rather than qualitative methods being used where possible. A brief survey of the life-history is given. Under favourable conditions the larva will enter any species of seed unless it is prevented by an impenetrable testa, such as one with a sclerenchymatous layer of 0·045 mm. and over. After boring through the testa, the first-instar larva tunnels through or on the surface of the cotyledon, and then makes the permanent larval chamber. In poisonous seeds, such as *Lupinus luteus*, the tracks are never more than 2 mm. long and the larva fails to moult. The mortality in unsuitable hosts increases from the first to the fourth instar. There is a marked and progressive difference between suitable food-plants, such as haricot beans (*Phaseolus vulgaris*) and *Cicer arietinum*, and unsuitable ones, such as *Vicia sativa* and *Lupinus luteus*. The larva may be successfully reared in meal, the stages observed there being probably comparable with those in nature. The body-size, fertility and total development period are affected, but not to an equal extent, by unsuitable food. The size of the egg is less affected than the body-size of the parent. Where choice exists, the specific food-plant receives 50 per cent. of the eggs laid by the female. Only when it is absent is much distinction drawn between the other food-plants, that most similar in texture and form being apparently chosen. The principle of host selection, that species which breed in two or more hosts will prefer to continue to breed in the host

to which they have become adapted, did not operate. Beetles were reared on *Phaseolus vulgaris* (the specific food-plant) and set to oviposit on *Cicer arietinum*. Their progeny through 5 generations continued to show a marked preference for *Phaseolus vulgaris*. Similar results were obtained in experiments with *P. vulgaris* and *P. multiflorus*. The best food-plants have a high carbohydrate content, but such food-plants may become unfavourable through the inclusion of an alkaloid or other unsuitable ingredient (possibly proteid).

PUSTER (—). **Vorratspflege in Maikäferrevieren.** [The Selection System in Forests infested by Cockchafers.]—*Z. angew. Ent.* **22** no. 1 pp. 51–60, 6 refs. Berlin, June 1935.

Recent decisions in Germany imply a definite change from the clear-cutting system of forestry to the selection system. Practices belonging to the latter system have long been in use. Intensified selection can be freely employed in stands where infestation by cockchafers is not serious.

When infestation is severe, measures against the eggs, larvae and pupae in the ground are impracticable. Arsenical stomach poisons and contact poisons are useless against the adults, as in fact they act as repellents. Over a series of flight-years thorough and regular collections, in which the beetles are shaken on to sheets from trees with young and tender foliage, when they congregate, helps greatly in restoring forests.

RUDNEW (D. F.). **Der grosse Eichenbock, *Cerambyx cerdo* L., seine Lebenweise, wirtschaftliche Bedeutung und Bekämpfung.** [The large Oak Cerambycid, *C. cerdo*, its Bionomics and Control.]—*Z. angew. Ent.* **22** no. 1 pp. 61–96, 14 figs., 3 graphs, 39 refs. Berlin, June 1935.

This paper is an extract from the author's Russian monograph on *Cerambyx cerdo*, L., which was a serious pests of oaks in the Ukraine. The information given is taken from the literature and from extensive observations made from 1927 to 1933 in 30 forestry divisions covering about 350,000 acres with about 200,000 infested oaks. A brief description of the morphology of all stages is followed by data on this Cerambycid's distribution in Europe (particularly Russia), food-plants (chiefly oak), bionomics and control. The last two are dealt with in much greater detail than in a previous paper [*R.A.E.*, A **17** 147]. The Encyrtid, *Tyndarichus rudnevi*, Now., parasitised up to 50 per cent. of the eggs [*cf. loc. cit.*], and fungi sometimes infested 73 per cent. of the young adults, 49 per cent. of the larvae and 36 per cent. of the pupae.

Wadding soaked in carbon bisulphide should be placed in mines in valuable trees. In large scale work, collecting the adults is only useful as a supplement to a change from the forestry methods that have increased infestation [*loc. cit.*]. As the beetles first attack trees on the edges of clearings, trees are no longer felled in isolated strips in the Ukraine, but contiguous areas of forest are cleared in successive years. Reserve oaks were not allowed to remain in stands consisting mainly of mixed trees. As a result of these measures, large infestations by *C. cerdo* no longer occur in the Ukraine.

Tuleschkov (K.). **Ueber Ursachen der Ueberwinterung der** *Lymantria dispar, L. monacha* **und anderer Lymantriiden im Eistadium.** [On the Causes of Hibernation in the Egg-Stage of *Porthetria dispar, Lymantria monacha* and other Lymantriids.]—*Z. angew. Ent.* **22** no. 1 pp. 97–117, 11 figs., 24 refs. Berlin, June 1935.

The embryos of all the Lymantriids that are forest pests in Central Europe develop quickly until, in about a fortnight after oviposition, there is an externally fully developed larva in the egg-shell. The larvae of *Stilpnotia salicis*, L., *Dasychira pudibunda*, L., and *Nygmia phaeorrhoea* Dön. (*Euproctis chrysorrhoea*, auct.) hatch at once, while those of *Porthetria* (*Lymantria*) *dispar*, L., *Lymantria monacha*, L., and *Malacosoma neustria*, L., aestivate and hibernate, finally hatching in spring at the first permanent rise in temperature. The reasons for this difference were investigated at Prague. The eggs of *Bombyx mori*, L., represented the early hatching species and those of *P. dispar* the late ones. Eggs of *L. monacha*, *M. neustria*, *N. phaeorrhoea*, and some other Lepidoptera were also used.

The observations are described in detail. The postponement of hatching was found to be due to a slowing down of internal metabolism. The remains of the yolk in the intestine of the embryo were not absorbed, and the consumption of oxygen and loss of water were diminished. As long as the intestine contained traces of the yolk the larva did not gnaw through the egg-shell. Attempts to re-activate the metabolic processes by a constant rise of the external temperature failed, so that the causes of the retardation would seem to be unaffected by warmth. Only after about 3 months did the capacity for absorbtion return. It was then subject to cold and heat. If it was set going by warmth the eggs hatched within a few days. The laws relating to the influence of temperature on insect development are not valid during the period of embryonic quiescence. It is suggested that the geological history of Lymantriids may furnish a theoretical explanation of their differences in behaviour.

Gasow (H.). **Beitrag zur Bekämpfung der Kohlfliege** (*Phorbia brassicae* **Bché.) durch flüssige und streufähige Mittel.** [A Contribution to the Control of the Cabbage Fly by Sprays and Dusts.]—*Z. angew. Ent.* **22** no. 1 pp. 118–130, 3 figs., 9 refs. Berlin, June 1935.

In view of the serious injury to cabbages by *Phorbia brassicae*, Bch., in Westphalia, numerous laboratory and field experiments were made to ascertain if the highly effective but extremely poisonous mercury bichloride could be replaced by less toxic substances. All the work was directed against the eggs. Laboratory experiments with calomel [mercurous chloride] were so satisfactory that a 0·05 per cent. solution was tested in the field in comparison with a 0·06 per cent. solution of mercury bichloride and gave quite as good results. Of other substances, proprietary tar distillates, even in such low concentrations as 0·3–0·4 per cent., also gave good results [*cf. R.A.E.*, A **19** 501], and should be effective substitutes for mercury bichloride.

Schedl (K. E.). **Die Organisation des entomologischen Dienstes in Kanada.** [The Organisation of the Entomological Service in Canada.]—*Z. angew. Ent.* **22** no. 1 pp. 143–156. Berlin, June 1935.

This paper outlines the work done by the various divisions of the Canadian Entomological Service.

PARKER (J. R.). **Factors largely responsible for Years of Grasshopper Abundance. (Summary.)**—*Proc. Wld's Grain Exhib. & Conf. 1933* **2** pp. 472–473, 6 diagrs. Ottawa, Canad. Soc. tech. Agric., 1935.

In the Great Plains region of North America rainfall during May and June and temperature during July, August and September appear to be the most important meteorological factors causing fluctuations in grasshopper abundance. This conclusion is supported by six charts for different areas in the northern prairies of the United States, showing variations from the normal in rainfall during May–June, and in temperature during July–September, for a number of years. In every instance the outbreaks have been preceded by 2–4 years during which either the rainfall was below normal during May and June, or the temperatures were above normal from July to September.

CRIDDLE (N.). **Studies in the Biology of North American Acrididae Development and Habits.**—*Proc. Wld's Grain Exhib. & Conf. 1933* **2** pp. 474–494, 9 refs. Ottawa, Canad. Soc. tech. Agric., 1935.

Egg-laying, hatching, development, moulting, feeding preferences, hibernation and migration in a number of North American ACRIDIDAE, and the factors affecting them are discussed. All species oviposit repeatedly, the number of egg-pods and eggs ranging from 4 to 25 and from 100 to over 500, respectively. As a rule the rise from minimum to maximum numbers is brought about by favourable weather combined with the absence of natural enemies. In addition, during the initial rise the insects are abnormally virile, depositing more eggs and surviving in greater numbers; after the peak is reached, the decline is aided by lessened vitality. Adverse weather conditions are more detrimental to adults late in the season than to nymphs in spring; the latter can be destroyed by abnormally heavy rainfall, but are able to survive cold and prolonged damp spells.

Migrations are as a rule made by adults, but sometimes nymphs show sustained movement. In some cases migrations are undertaken in search of new feeding grounds, but usually flight is due to an impulse in which food plays no part.

Lists of plants preferred by different species are included, and descriptions of a number of ecological associations, including particulars of soils, vegetation and grasshopper fauna are given. It was found that soil was the most important factor in assigning the assemblages of certain Orthoptera to definite zonal areas.

MITCHENER (A. V.). **Grasshoppers and their Control in Manitoba.**—*Proc. Wld's Grain Exhib. & Conf. 1933* **2** pp. 495–499, 1 ref. Ottawa, Canad. Soc. tech. Agric., 1935.

Some of the information contained in this paper has been noticed before [*R.A.E.*, A **23** 235, etc.]. The water-carrying capacity of various carriers for poison baits was determined, and it is suggested that young green wheat plants, which carry 94 per cent. of water, make the best carrier for grasshopper bait. Experiments in exposing dried carriers to outdoor air proved that once a bait becomes dried out it will not absorb much water from the atmosphere.

Ruggles (A. G.). **Organisation of Grasshopper Control Campaigns in the United States.**—*Proc. Wld's Grain Exhib. & Conf. 1933* **2** pp. 499–508. Ottawa, Canad. Soc. tech. Agric., 1935.

This is a more detailed account of the organisation adopted in Minnesota during the 1932 grasshopper campaign, which has already been noticed [*R.A.E.*, A **22** 278].

Wood (H. E.). **The Organization of Grasshopper Control Campaigns on the Canadian Prairies.**—*Proc. Wld's Grain Exhib. & Conf. 1933* **2** pp. 508–514. Ottawa, Canad. Soc. tech. Agric., 1935.

In Manitoba in 1932, the area threatened by grasshoppers comprised about 2,000,000 acres of cultivated land. The quantity of wet bait distributed to farmers was 16,600 tons, and the total expenses were over £36,000, the saving in grain being estimated at 20,000,000 bushels. The organisation of the campaign is described in considerable detail.

Vigor (S. H.). **Grasshopper Control Campaigns in 1931–33 in Saskatchewan.**—*Proc. Wld's Grain Exhib. & Conf. 1933* **2** pp. 515–516. Ottawa, Canad. Soc. tech. Agric., 1935.

During the grasshopper campaign in Saskatchewan in the years 1919–1923, *Camnula pellucida*, Scud., was the dominant species. In the campaign which started in 1931, *Melanoplus mexicanus*, Sauss. (*atlantis*, Riley), *M. packardi*, Scud., and *M. bivittatus*, Say, were most numerous, and as these species lay eggs in stubble and wheat fields, the problem of control was more complicated and expensive. In 1931 the infested area was 10,000,000 acres, in 1932 it increased to 18,000,000 acres, and still further expansion occurred in 1933. In 1932 the quantity of dry bait distributed to farmers was 1,800 tons, and in 1933 it was as much as 6,482 tons.

Gray (E. L.). **Grasshopper Control Campaigns in Alberta 1931–1933.**—*Proc. Wld's Grain Exhib. & Conf. 1933* **2** pp. 517–519. Ottawa, Canad. Soc. tech. Agric., 1935.

The first extensive grasshopper outbreak in Alberta occurred in the years following the Great War, and in 1922 about £50,000 was spent on their control. Between 1923 and 1931 there was no noticeable damage from grasshoppers, but in 1931 a new outbreak commenced in the dry areas of the province with sparse population, and by 1933 the infestation had spread more widely. In 1931 about £1,300 was spent on control, in 1932 £9,300, and in 1933 approximately £20,000. The cost of arsenic is not included in these figures.

Strickland (E. H.). **The Biology of Prairie inhabiting Wireworms.**—*Proc. Wld's Grain Exhib. & Conf. 1933* **2** pp. 520–529, 8 refs. Ottawa, Canad. Soc. tech. Agric., 1935.

A summary is given of observations made during six years on some of the factors affecting wireworms in Alberta. The life-history is hard to study because the life-cycle is long and all individuals do not behave in the same way under the same conditions. Among 30 newly hatched larvae of a variety of *Corymbites aeripennis*, Kby. (*Ludius tinctus*, Lec.) kept from June 1925 under similar conditions of temperature, moisture and food-supply, there were great differences in the rate

at which they developed, the number of times they moulted and the intervals during which they fasted. Some at 4 years old were smaller than they had been at 2 years, although they had fed freely throughout. Some pupated while small, whereas others although they were much larger died immature.

The life-history of *C. aeripennis* [*cf. R.A.E.*, A **16** 328] is given. In parklands and open prairie there is an equilibrium between the potential for increase and that for mortality among quite small populations, but this equilibrium is upset by cultivation, and is only re-established when the population is very dense. Damage tends to become more intense and extensive in fields that have been cultivated for a long time. Wireworms are generally most harmful in fields that have been cultivated for at least 12 years, but after about 20 years populations fluctuate without increasing. There are not yet enough data to show precisely how cultivation produces this effect, and the factors governing the density of populations are unknown. Some possible explanations are discussed. It is believed that factors regulating the depth of oviposition have some effect on the relative density of population in different habitats. In recently cultivated soil the eggs are laid about 6 inches below the surface, and it has been observed that many eggs laid near the surface, as are those laid in hard soil, die from fluctuations in moisture and temperature.

LANE (M. C.). **Recent Progress in the Control of Wireworms.**—*Proc. Wld's Grain Exhib. & Conf. 1933* **2** pp. 529–534, 19 refs. Ottawa, Canad. Soc. tech. Agric., 1935.

A list of the chief Elaterid genera is given from the literature, and the distinguishing features of each group are briefly indicated, individual species being cited as examples. In the United States, species of *Corymbites* and *Ludius* are mainly pests of dry land crops, moisture being the restricting factor in their distribution. Species of *Limonius*, on the other hand, are commonly found in moist soil conditions and in conjunction with intensely cultivated crops like potatoes, onions, beans, maize and melons ; some species cannot live where the annual rainfall is less than 18 inches. This group is also associated with soil alkalinity. Species of *Melanotus* are mainly destructive to maize and other field crops in the Eastern and Middle Western United States and are particularly injurious after the sod has been ploughed up. Although they can exist under varying conditions of moisture, they do not increase to such large populations as *Corymbites* or *Limonius*. Species of *Agriotes*, the most injurious genus in England and Western Europe, are more prevalent and do more damage on lands tending to acidity. Many species of *Monocrepidius* and *Heterodercs*, which are injurious only in the tropics and sub-tropics, are of economic importance in the South Atlantic and Gulf States. The life-cycle of these species is completed in one year. Another group of wireworms is represented by *Horistonotus uhleri*, Horn, which inhabits the sandy lands of the southern States, thriving only on sandy soil in the absence of humus.

Various methods of control tested against *Corymbites* and *Limonius* are discussed. Baits are ineffective, Carbon bisulphide killed 80–100 per cent. [*R.A.E.*, A **20** 682], but fumigants are costly and have to be applied during the cropping season. It is probable that control will

eventually be effected by cultural practices. Experiments with *Limonius* have shown that fluctuations in wireworm populations are affected even more by moisture than by temperature. Other factors are soil texture, availability of plant food and, perhaps, the chemical constituents of the soil. The greatest injury is done in the spring and early summer when the soil is cool and moist. High temperatures in summer drive the wireworms deeper into the soil. Recent experiments have shown that flooding controls wireworms when the temperature of the water is raised to 70–80°F.; at this temperature the activities of the Elaterids increased and the length of time they were able to survive under water became shorter as the heat increased. In experiments carried out in July, August and September 95–100 per cent. of the wireworms were killed in a week of flooding at a soil temperature of 78°F., though flooding below 70°F. seems to be ineffective. Laboratory investigations have shown that of the normal larval mortality of 90 per cent., three-quarters is caused during the first year, mainly by starvation and desiccation. Clean summer fallowing will deprive wireworms of food. Dry-land wireworms can survive in a fallow field even where moisture is very low, but several species require a certain amount of moisture during the first few months of their existence. Laboratory experiments have shown that *Limonius* spp. cannot survive more than 48 hours when the relative humidity is below 90 per cent., which corresponds to a total moisture content of 5 per cent. in clay loam soil on dry-weight basis. Drying the soil on irrigated land in humid climates in the summer months by growing grain or forage crops should therefore reduce their numbers. Populations could be kept low by rotating crops so that any given field could be dried out once in 4–5 years. These measures are only known to be effective against *Limonius*.

SEAMANS (H. L.). **The Pale Western Cutworm as a Factor in Prairie Agriculture.**—*Proc. Wld's Grain Exhib. & Conf. 1933* **2** pp. 535–538. Ottawa, Canad. Soc. tech. Agric., 1935.

The course of outbreaks of *Porosagrotis* (*Agrotis*) *orthogonia*, Morr., in Southern Alberta [*cf. R.A.E.*, A **20** 691; **23** 467] and the development of control measures are outlined. Oviposition occurs during the period of main flight between 10th August and 5th September. Ovipositing moths prefer a loose dusty soil. Eggs normally overwinter and hatch at the end of April or early in May, though if the soil is dry they may not hatch until moisture becomes available. Though the larvae may move in the field in which they hatched, they do not migrate from one field to another. About 15th–20th June the mature larvae form earthen cells about 2 inches below the surface and remain in them until pupation takes place about 15th July. The moths emerge about 1st August. All fields should be cropped and left entirely undisturbed during August. Rainfall occurring before and during the flight will crust the soil sufficiently to render it unsuitable for oviposition. Cultivation, pasturing, heavy plant growth or wind are liable to break this crust. The success of this method, which has been maintained for 10 years, has recently been impaired in some places by the drift of soil containing eggs from fields thoroughly cultivated in August. The rearrangement of the farm programme required is discussed.

LARRIMER (W. H.). **The Hessian Fly in the United States.**—*Proc. Wld's Grain Exhib. & Conf. 1933* **2** pp. 538–543, 4 refs. Ottawa, Canad. Soc. tech. Agric., 1935.

The distribution, life-history and natural and artificial control of *Mayetiola* (*Phytophaga*) *destructor*, Say, in the United States are reviewed, mainly from the literature. Although under favourable conditions the fly can be held completely in check at little or no extra cost, sporadic outbreaks have occurred from time to time as a result of negligence or of exceptional weather. It is not likely that insecticides would be of much use, but where infestation is not too severe resistant varieties of grain can profitably be grown. Ploughing in the stubble, destroying self-sown wheat, and rotating and timing the crops should prevent severe infestation if all wheat growers in a district co-operate.

CAFFREY (D. J.). **The European Corn Borer in the United States.**—*Proc. Wld's Grain Exhib. & Conf. 1933* **2** pp. 544–551. Ottawa, Canad. Soc. tech. Agric., 1935.

Much of the information contained in this review of the history and control of *Pyrausta nubilalis*, Hb., in the United States has already been noticed [*cf. R.A.E.*, A **21** 236; **22** 106; **23** 175, 247, etc.]. From 1925 to 1932 the average number of borers per 100 maize plants has increased from 3·5 to 33·5. Concentration of *P. nubilalis* in the one-generation area seems to be moving southward in Ohio and Indiana; in the two-generation area it seems to persist along the Atlantic coast of Massachusetts and Rhode Island, south-eastern Connecticut, Long Island and New York. Small varieties of maize were a little worse damaged than medium or large varieties. The loss per borer is much greater in highly productive soils than in poor soils. A review of the results obtained by various workers shows that over three years the larval survival in hybrids produced by using crosses of the most resistant inbred strains so far developed was on an average 46 per cent. less than in hybrids produced by using crosses of the most susceptible inbred strain. Hybrids that were most resistant in tests during 1931 and 1932 also produced the highest yields. In general the strains that yield most suffered the greatest reduction per borer per plant. Rigidity of the stalk is an important factor of tolerance, as the plants then escape with the least breakage below the ear, which thus has a better chance to develop fully. Experiments to determine the best date to plant showed that the borers are more destructive in maize that is planted late, and this loss combined with the normal reduction in yield from late planting offsets the advantages of lower borer populations.

FLINT (W. P.). **The Chinch Bug as a Pest of Corn on the American Continent.**—*Proc. Wld's Grain Exhib. & Conf. 1933* **2** pp. 552–554. Ottawa, Canad. Soc. tech. Agric., 1935.

The history of the chinch bug [*Blissus leucopterus*, Say] as a pest of maize in various parts of the United States and Canada is traced from 1783 up to the present day [*cf. R.A.E.*, A **23** 456]. Control measures are briefly summarised.

GRAY (H. E.). **The Hairy Spider Beetle,** *Ptinus villiger* **Reit. in Canada.** —*Proc. Wld's Grain Exhib. & Conf. 1933* **2** pp. 555–561, 2 pls., 1 ref. Ottawa, Canad. Soc. tech. Agric., 1935.

Ptinus villiger, Reitt. [*cf. R.A.E.*, A **13** 579], which has become common in flour warehouses in Manitoba and Saskatchewan, occurs more rarely in Alberta, and has been recorded from British Columbia. It has not yet been found in any of the flour mills of western Canada. Infested flour has to be sold for feed, and the beetle gets into all the foodstuffs handled by millers although it does not always damage them. All stages are described and details are given of the numbers found in infested material.

The adults appear in the flour sheds with the first warm spring days. About 1 per cent. of the adults emerging in early autumn survive the winter, but adults only live a few weeks at higher temperatures. Pairing was observed in spring between 16 and 22°C. [60·8 and 71·6°F.]. One female laid 40 eggs. The eggs are laid singly in flour débris in cracks, on the outside of bags or through the mesh of the sacks. At temperatures of 22, 24, 26, and 28°C. [71·6, 75·2, 78·8 and 82·4°F.] the first hatching in the insectary took place after 10, 7, 5 and 5 days respectively and half the eggs had hatched by 13, 11, 10 and 9 days respectively. Approximately 3 months was required for larval development at 30°C. [86°F.]. Pupation may occur within the sack, but many larvae ate their way through the bags and pupated in rubbish on the floor or burrowed into the wood of the shed. Many larvae overwinter in the pupal cell and pupate in the spring or later. The larvae are very resistant to cold. A small Chalcidoid parasitises the larvae and a small black spider feeds on the adults, but neither seems to be important. Sprays of extract of pyrethrum and kerosene, applied as soon as the adults appeared in spring, destroyed many of the beetles and did not affect the flour. Applications should be made late in the afternoon 3 times a week. Directions for spraying are given. The floor, racks and walls should also be sprayed, and in very heavily infested warehouses the walls and floor should be sprayed with 1 gal. lye in 5 gals. water.

HUSAIN (M. A.). **Pests of Wheat Crop in India.**—*Proc. Wld's Grain Exhib. & Conf. 1933* **2** pp. 562–564. Ottawa, Canad. Soc. tech. Agric., 1935.

The most harmful insect pest of wheat in India is *Microtermes obesi*, Holmgr., which causes an average total loss of about 6 per cent. and occasionally destroys as much as 25 per cent. of germinating grain. Where the temperature is high and the soil moisture low the dried up underground portions of seedlings are eaten, and occasionally, in certain parts of India, plants coming to ears are also attacked and severely damaged. Large colonies of *Macrosiphum avenae*, F. (*granarium*, Kby.), which is second in importance, appear in developing ears of wheat, but are kept in check by predators and parasites. Other pests of wheat are : *Chrotogonus* sp., *Atractomorpha crenulata*, F., *Tanymecus indicus*, Fst., and *Spodoptera mauritia*, Boisd., which cause slight damage to seedlings by nibbling off the young leaves, *Mylloceras discolor*, Boh., *Cirphis unipuncta*, Haw., and *Aiolopus tamulus*, F., which feed on leaves and destroy them, *Sesamia inferens*, Wlk., which bores into the stem and kills the central leaf, and *Schistocerca gregaria*, Forsk.

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WHITE (M. J. D.). **Eine neue Form von Tetraploidie nach Röntgenbestrahlung.** [A new Form of Tetraploidy after X-ray Treatment, *Locusta migratoria migratoriodes*, R. & F.]—*Naturwissenschaften* **23** no. 24 pp. 390–391, 2 figs. Berlin, 1935.

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SAWA (R.). **Fauna of the Soil in the Fields near the City of Mito. Especially seasonal Migrations of White Grubs and Others.** [*In Japanese.*]—*Oyo-Dobuts. Zasshi* **7** no. 3 pp. 99–102. Tokyo, June 1935.

SAWA (R.). **Fauna of the Soil in the Paths of the Rice Fields in Winter near the City of Mito.** [*In Japanese.*]—*Oyo-Dobuts. Zasshi* **7** no. 3 pp. 102–104. Tokyo, June 1935.

HARUKAWA (C.), TAKATO (R.) & KUMASHIRO (S.). **Development of the hibernating Rice-borer** [*Chilo simplex*, Butl.] **and Damp.** [*In Japanese.*]—*Oyo-Dobuts. Zasshi* **7** no. 3 pp. 108–109. Tokyo, June 1935.

YATOMI (K.). **The least Luminosity causing phototropic Reaction to** *Chilo simplex*, **Butl.** [*In Japanese.*]—*Oyo-Dobuts. Zasshi* **7** no. 4 pp. 198–200. Tokyo, July 1935.

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